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Scientific and Technical Aerospace Reports (STAR) is a major component of a comprehensive National Aeronautics and Space Administration information system covering aeronautics, space, and supporting disciplines. *STAR* is issued on the 8th and 23rd of each month and announces current publications of the following types:

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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

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20 SPACECRAFT PROPULSION AND POWER 2640

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For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

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Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

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Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

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83 ECONOMICS AND COST ANALYSIS 2745
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 2745
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 2745
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) 2747

89 ASTRONOMY 2747
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 2748
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 2748
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 2749
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 2749
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

GENERAL

99 GENERAL 2750

Note: N.A. means that no abstracts were assigned to this category for this issue.

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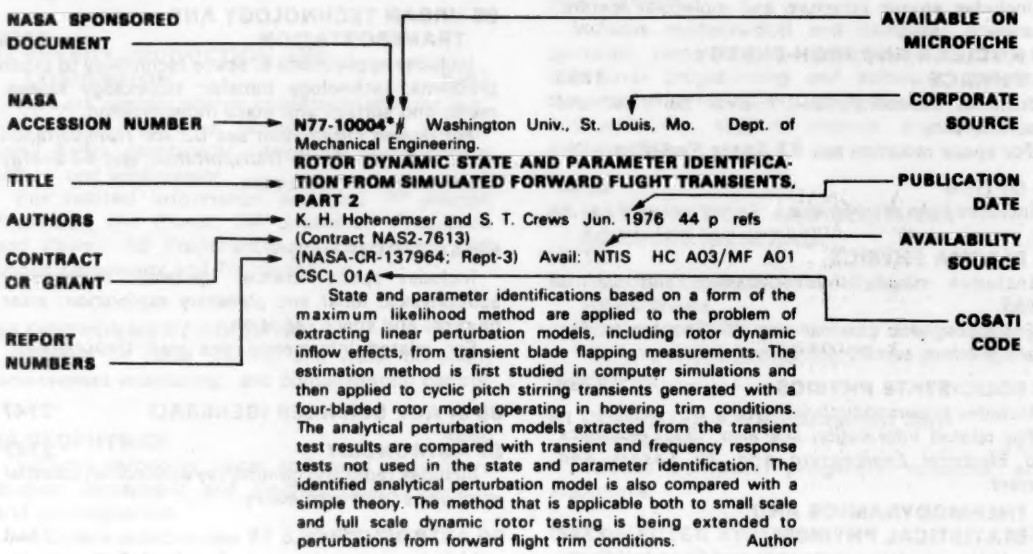
TYPICAL CITATION AND ABSTRACT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N77-10004*# Washington Univ., St. Louis, Mo. Dept. of Mechanical Engineering.
TITLE
ROTOR DYNAMIC STATE AND PARAMETER IDENTIFICATION FROM SIMULATED FORWARD FLIGHT TRANSIENTS, PART 2
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K. H. Hohenemser and S. T. Crews Jun. 1976 44 p refs
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REPORT NUMBERS
State and parameter identifications based on a form of the maximum likelihood method are applied to the problem of extracting linear perturbation models, including rotor dynamic inflow effects, from transient blade flapping measurements. The estimation method is first studied in computer simulations and then applied to cyclic pitch stirring transients generated with a four-bladed rotor model operating in hovering trim conditions. The analytical perturbation models extracted from the transient test results are compared with transient and frequency response tests not used in the state and parameter identification. The identified analytical perturbation model is also compared with a simple theory. The method that is applicable both to small scale and full scale dynamic rotor testing is being extended to perturbations from forward flight trim conditions. Author

ON-GOING RESEARCH PROJECTS

This is a listing of research projects – not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, REMOTELY PILOTED VEHICLE (RPV) STRUCTURAL COMPONENTS INVESTIGATION (SPACEWIND)
K.J. REILLY, Fiber Science Incorporated, *Gardena, California* 90248 (DA0D4063; DAAJ02-76-C-0040)

To develop manufacturing methods and techniques which will reduce cost and weight of RPV structural components while maintaining or improving payload, reliability, maintainability, survivability and reducing detectability. Particular emphasis is to be placed on the capabilities of manufacturing structural shapes and attachment points in a cost-effective manner.

Existing RPV designs will be evaluated as will existing manufacturing methods and techniques. Particular emphasis is to be placed on the applicability of the 'spacewind' material and its associated production and fabrication techniques. Trade-off studies will be performed to determine the relative merits of the various materials. New structural concepts will be evaluated. Ease of fabrication will be a prime consideration.

ADDENDA: Supporting agency address is: AVSCOM Air Mobility R D Lab, Eustis Dir, Ft Eustis, VA 23604

SUPPORTED BY U.S. Dept. of Defense, Army

1.0002, A STUDY OF STALL AVOIDANCE TO DETERMINE STALL PREDICTION CRITERIA
T. LEONARD, Calif. State Univ. & Colleges, School of Applied Sci. & Arts, *San Jose, California* 95114 (NCA 2-675709)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

1.0003, DESIGN OF BALLISTIC-DAMAGE-TOLERANT CROSS BEAM TAIL ROTOR
B. SELLECK, Sikorsky Aircraft Company, *Stratford, Connecticut* 06602 (DA0D4088; DAAJ02-77-C-0004)

To design, fabricate, and evaluate a survivable four blade cross beam tail rotor severance system applicable to the UTTAS class aircraft.

The proposed program shall be conducted by the following tasks: Task I - concept analysis - contractor shall review all previous data of previous work relating to both main and tail rotor blade severance for application to a survivable cross beam tail rotor design. Task II -design - contractor shall design a tail rotor blade severance system based on results of Task I. Task III - system fabrication and evaluation - contractor shall fabricate a prototype system and conduct lab tests to verify operation. Task IV - flight simulation analysis - contractor shall develop a computer program to simulate loss of tail rotor blades and examine the effects of blade separation on the helicopter.

ADDENDA: Supporting agency address is: AVSCOM Air Mobility R D Lab, Eustis Dir, Ft Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense, Army

1.0004, DSTR/501-M62B DYNAMIC INTERFACE DOCUMENTATION
W.H. PARKER, General Motors Corporation, *Indianapolis, Indiana* 46206 (DA0D4078; DAAJ02-76-C-0072)

To document to the extent possible the investigation into the DSTR/501-M62B dynamic interface problem and the resulting solution.

A. Conduct a search of existing engine and airframe files related to the interface problem. All reports, memoranda, calculation design studies, etc. shall be collected for use in documenting the investigations. B. Prepare a final report which will identify the problem, present the investigations leading to a solution, and describe the resulting configuration.

ADDENDA: Supporting agency address is: AVSCOM Air Mobility R D Lab, Eustis Dir, Ft Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense, Army

1.0005, A STUDY OF LOW-COST, RELIABLE ACTUATORS FOR SINGLE-ENGINE LIGHT AIRCRAFT
J. ROSKAM, Univ. of Kansas, School of Engineering, *Lawrence, Kansas* 66044 (NSG 1421)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

1.0006, CANOPY GLINT SCREENING INVESTIGATION - ARMY HELICOPTERS
P. GUNDLING, Boeing Company, *Philadelphia, Pennsylvania* 19142 (DA0D4071; DAAJ02-76-C-0061)

Investigate helicopter canopy concepts that have the potential of eliminating/reducing the sun glint signature and internal reflections associated with current designs.

Identification and screening of promising concepts for both attach and observation helicopter applications and the fabrication, test, and evaluation of those concepts that analysis indicate are capable of satisfying the requirement.

ADDENDA: Supporting agency address is: AVSCOM Air Mobility R D Lab, Eustis Dir, Ft Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense, Army

1.0007, ELEVENTH INTERNATIONAL SHOCK TUBE SYMPOSIUM
A. HERTZBERG, Univ. of Washington, School of Engineering, *Seattle, Washington* 98105 (DF045750; AF-AFOSR-3096-76)

AF function - aerospace vehicles. Opportunity - shock tubes are one of the more versatile tools in modern research and technology, and the use of the shock tube has provided the basis not only of high-enthalpy gas dynamics and shock wave research but have also been responsible for the development of gas kinetic physics which placed reentry physics on a firm foundation as well as the development of high-power gas lasers. The opportunity is to support this symposium as a way to provide good communication on a large number of topics ranging from reentry to transonic flow, to high-power lasers which are all-important to the Air Force but are not exhaustively covered by research programs of the Air Force. Objective - to continue to provide an effective forum for discussion, on a scientific level, and on an international basis of the latest developments in shock tube techniques, con-

cepts, applications and instrumentation. How work contributes - these symposia not only furnish an effective means for scientists to interact, but they also help science sponsoring agencies recognize areas of research that could profitably be expanded and areas which may already have run their course.

A scientific symposium running for four days during July, 1977 will be organized. Papers will be presented on topics in shock tube research and applications; proceedings will be published.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NA, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, EXPERIMENT DEFINITION AND INTEGRATION STUDY FOR ACCOMMODATION OF MAGNETIC SPECTROMETER PAYLOAD ON SPACELAB/SHUTTLE MISSIONS

A. BUFFINGTON, Univ. of California, Space Sciences Laboratory, *Berkeley, California* 94704 (NAS 5-24165)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

2.0002, REVIEW OF ALTERNATE POWER SYSTEMS IN RELATION TO SOLAR POWER SATELLITE CONCEPTS

A.V. DAROSA, Stanford University, School of Engineering, *Palo Alto, California* 94305 (NAS 9-15317)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, GRAIN BOUNDARY SLIDING AT HIGH TEMPERATURES

T.G. LANGDON, Univ. of Southern California, School of Engineering, *Los Angeles, California* 90007 (INT76-82951)

This award provides supplemental support for the principal investigator to spend six months at the University of Melbourne's Department of Metallurgy where he will collaborate with Dr. R.C. Gifkins on investigations of grain boundary sliding (GBS) at high temperatures. Their objectives are twofold.

They will focus primarily on experimentation to measure GBS in fatigue, and to investigate the effect on GBS of the type of fatigue stress. Although there is great current interest in this topic for a wide range of structural materials (e.g., for pressure vessels, in nuclear reactors and in some aircraft components) there are virtually no measurements. It is expected that these experiments will establish the procedures which will form the basis for continued work in both the United States and Australia.

In addition, the collaborators will do the basic work for a major review paper on the entire field of GBS.

SUPPORTED BY U.S. National Science Foundation, Div. of International Programs

3.0002, ANGULAR-DEPENDENT PHOTOELECTRON SPECTROSCOPY COMBINED WITH OTHER METHODS TO SURFACE-CHEMICAL- AND SOLID-STATE-ANALYSIS

C.S. FADLEY, Univ. of Hawaii, School of Arts & Sciences, *Honolulu, Hawaii* 96822 (CHE76-24506)

A unique experimental system combining several surface-sensitive experiments will be constructed and applied to certain problems in surface-chemical- and solid-state-analysis. The techniques involved are angular-dependent x-ray photoelectron spectroscopy (XPS), angular-dependent ultraviolet photoelectron spectroscopy (UPS), low-energy electron diffraction (LEED), Auger electron spectroscopy (AES), and thermal desorption mass spectroscopy. Photoemission experiments will also be performed with an existing facility at the Stanford Synchrotron Radiation Project. Particular emphasis will be placed on the further development and utilization of photoelectron angular distributions for the study of core- and valence-electronic structure, electron attenuation lengths, surface concentration profiles, valence state symmetries, and surface atomic geometries. The systems to be studied include single crystals of the transition-metal Ni, Cu, W, Pt layered compound TaSe2, the oxidations of Al and Si surfaces, chemisorption on stepped Pt single-crystal surfaces, the surface properties of the Cu/Ni alloy system, and magnetically ordered single crystals of MnO technology, catalysis and corrosion. Calculations directed at understanding the electronic structures of these systems and the angular dependence of photoelectron emission will also be carried out. The research represents a continuation of that currently supported by MPS-7505055.

SUPPORTED BY U.S. National Science Foundation, Div. of Chemistry

3.0003, HIGH-TEMPERATURE PROPERTIES AND PROCESSES IN CERAMICS - THERMOMIGRATION

H.K. BOWEN, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (EY-76-S-02-2923)

Th purpose of this research is to systematically study thermomigration. The planned research for the next year is: (a) completion of experimental measurements of thermomigration of cations in Fe-Al spinels using the CO2 laser heat source; (b) develop the experimental techniques (laser heating, controlled oxygen potentials) for thermomigration of oxygen and Ce/U segregation in the UO2 system; (c) further develop the thermochemical and kinetic model for thermomigration; (d) develop the numerical solutions to the time-dependent thermal diffusion equations in conjunction with an analysis of local equilibrium with the daughter-product produced by decay of a radioactive tracer; and (e) begin measurements of void and boundary migration due to thermal gradients.

RESULTS: (1) Analyzed the effects of thermal gradients on the electronic defects in FeO. (2) Started experiments on thermal redistribution in FeAl2O4-Fe3O4 spinels. (3) Purchased a high-power laser system which is the heat source for high thermal gradient experiments and have built the first sample chamber for doing controlled thermomigration experiments. (4) Used the ion probe (secondary ion mass spectrometer) in a difficult diffusion study to prove its usefulness as an analytical tool in our thermomigration study.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Physical Research

3.0004, DIFFRACTION STUDIES OF THE STRUCTURE OF GRAIN BOUNDARIES

S.L. SASS, Cornell University, School of Engineering, *Ithaca, New York* 14850 (DMR76-24180)

This is a continuation and extension of studies on the detailed nature of grain boundaries in metallic materials. Investigations underway include: (1) core structure of screw dislocations and the plane spacing in the vicinity of small angle grain boundaries; (2) structure of large angle grain boundaries; (3) segregation to grain boundaries; (4) variation of grain boundary structure with temperature; and (5) surface structure of thin films. This is a renewal of NSF Grant DMR74-20074.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

3.0005, STARK SPECTROSCOPY OF MOLECULAR SOLIDS
D.M. MANSON, State University of New York, School of Arts & Sciences, *Stony Brook, New York* 11790 (CHE75-09680 A02)

Dr. Hanson intends to continue a program of research currently supported by Foundation grant, GP-33427X. External electric fields combined with spectroscopic observations are to be used to obtain information about charge distributions in molecules and molecular aggregates and about energy and electron transfer and trapping processes in molecular systems. Research will be concentrated in the following areas: the location and characterization of charge transfer exciton states in single component molecular crystals, possible with the Stark technique because of the large dipole moments of these states; the measurement of dipole moments induced in molecules by environmental perturbations; the measurement of molecular dipole moments and polarizabilities in condensed phases to be assessed experimentally and theoretically; the measurement of space charge distributions in insulators, semiconductors, and photoconductors; the control of energy transfer in molecular crystals with external electric fields; and the utilization of coherent transient effects in Stark experiments to increase resolution and to provide information about molecular dynamics.

SUPPORTED BY U.S. National Science Foundation, Div. of Chemistry

3.0006, STRUCTURE OF GLASSES CONTAINING TRANSITION METAL IONS
W.B. WHITE, Penn. State University, Materials Research Laboratory, *University Park, Pennsylvania* 16802 (EY-76-S-02-2754)

This research concerns the structure and behavior of insulator glasses with respect to one family of additives, the transition metals. The research strategy is to prepare silicate, borate, and other host glasses, and to study the local structure, interaction with glass structure, influence on nucleation and crystallization and phase separation of a selected set of transition metal ions. Experimental approaches include: (1) structure of host glass by Raman spectroscopy; (2) local structure around the transition metal ion by optical spectroscopy; (3) experiments on the controlled reduction of transition metals from the glass to investigate the effect of oxygen activity in the glass and the way in which the transition ion is bound to the glass; and (4) use of luminescence to study intermediate-range interactions in glass.

RESULTS: Completed investigations include: (1) structure of nitrate glasses by Raman spectroscopy; (2) structure of lead silicate glasses by Raman spectroscopy; (3) identification of molecular chromate and dichromate groups in silicate and borate glasses; (4) optical and luminescence spectroscopy investigation of Cr ion in silicate glass; and (5) construction of a theoretical model for molecular relaxation in glass. Ongoing work includes role of titanium and iron in glass, Raman investigations of borate glass, and investigation of ultrapure glass.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Physical Research

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, STRUCTURAL OPTIMIZATION BY FINITE ELEMENTS
B.F. DEVEUBEKE, Univ. of Liege, *Liege, Belgium* (DF046090; AF-AFOSR-3118-77)

AF function - advanced and aerospace vehicles will require new design and optimization methods for future mission performance. Opportunity - new analysis techniques are becoming available which can significantly enhance vehicle structural designs to achieve more efficient behavior. Objective - the objective of this research is to investigate computerized algorithms which can yield optimal structural designs considering multiple constraints. How work contributes - this research contributes to Air Force programs investigating new vehicle design and analysis procedures.

Research will investigate the approaches to structural optimization. Relationships between math programming and optimality criteria will be examined through development of suitable algorithms. Structures to be considered will be idealized by finite-element techniques. These studies will examine solution convergence and techniques to improve convergence. In addition, multiple constraints which arise when considering flexibility, vibration and stability will be considered in algorithm formulations.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NA, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0002, DEVELOPING AND DEMONSTRATING AN INSTITUTIONAL MECHANISM FOR TRANSFERRING REMOTE SENSING TECHNOLOGY
D. HANKINS, Calif. State Univ. & Colleges, Graduate School, *Arcata, California* 95521 (NSG 2244)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

4.0003, TIME-DEPENDENT BOUNDARY LAYERS IN TRANSITION PREDICTION
J.H. STUHMILLER, Jaycor, *Del Mar, California* 92014 (DF047020; F49620-77-C-0030)

AF function - aerospace vehicles (ABRES). Deficiency - lack of adequate prediction methods for the transition of laminar to turbulent flows over ballistic reentry vehicles. Objective - to develop a method of transition prediction that will encompass all known nonempirical boundary layer theory leading to transition but which will be free of all present restrictive assumptions. How work contributes - this study will investigate the possibility of a novel method of approaching transition prediction theoretically and, if successful, should allow designers to optimally design reentry vehicles for heat and dynamic loadings.

An analytical-computational framework will be developed to apply boundary layer approximations to the solutions of the full Navier-Stokes equations for transition prediction.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NA, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0004, DRAG AND EXTERNAL-STORE IMPROVEMENTS TO DATCOM
R.D. FINCK, McDonnell Douglas Corporation, *Long Beach, California* 90808 (DF136830; F33615-76-C-3061)

Rapidly changing technology dictates that improvements be made in the USAF Stability and Control DATCOM if it is to retain its value as a source of current design information for military aerospace vehicles. This objective is for continual examination of all pertinent available data and theories, and for the integration into the DATCOM of improved and newly formulated prediction methods as soon as their value has been recognized and their validity substantiated. The coverage of recent findings relative to aerodynamic drag and to the effects of externally mounted stores on aircraft stability is especially timely.

Recently developed prediction techniques for aircraft drag in the subsonic and transonic speed regimes and for external store effects on lift, drag, side force, pitching moment, and yawing moment, will be integrated into the DATCOM. Specific information will be presented with each DATCOM method to indicate its range of applicability, limitations, accuracy, and derivation. Methods will be substantiated by tables such as those in the existing DATCOM. Both ground and flight-test data will be included, and sample problems will be provided for all DATCOM methods presented.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FGC, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0005, NUMERICAL SIMULATION OF TURBULENT FLOWS WITH A VORTEX-IN-CELL METHOD
O. BUNEMAN, Stanford University, School of Engineering, *Palo Alto, California* 94305 (NCA 2-745718)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

4.0006, BASIC ENVIRONMENTAL SERVICES
R. STRAUCH, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (RAA7 92 66)

PROJECT OBJECTIVE: 1. Determine the effects of antenna beamwidth and offset of the radar beam from the glide slope on wind profiles measured by radar. 2. Add capability of detecting winds in the clear air to existing FPS-18 radar at NAFEC test site. 3. Assist NAFEC in establishing experimental program and evaluating data.

CURRENT YEAR PLAN: A computer modeling of wind profiles and the radar resolution volume will be developed to compare the measured velocity profile with the actual profile. 2. An FAA-furnished antenna pedestal will be fitted with a purchased 15-ft antenna with excellent sidelobe suppression. Existing data system at NAFEC will be modified as needed to process weather echoes for Doppler data. 3. A test program will be set up at NAFEC to evaluate radar results.

PROGRESS REPORT: This is a new task being added to an existing contract with FAA. Previous progress related to this task is the successful demonstration of pulse Doppler radar for wind shear detection at NSSL.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin., Systems Research & Development Service

4.0007, A LOW-NOISE 47 GHZ MIXER USING A PERMANENT JOSEPHSON JUNCTION
J. EDRICH, Univ. of Denver, Denver Research Institute, *Denver, Colorado* 80210 (AST76-23094)

Low noise mixers for radio astronomy use will continue to be developed. The mixers will utilize permanent point contact Josephson effect devices, which will be installed into wafer packages. The packages will be integrated into a receiver system using a currently available maser as the intermediate frequency amplifier. Windows and radiation shields will be attached and the whole unit will be mated to an existing 300 GHz scalar horn. Initial testing of the completed system will be carried out. The frequency range will extend from 220 to 325 GHz.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

4.0008, THE ROLE OF COLLISIONS OF THE SECOND KIND IN THE HE-SE AND HE-NE-TE LASERS
G.J. COLLINS, Colorado State University, School of Engineering, *Fort Collins, Colorado* 80521 (ENG74-01029 A01)

In the He-Se He-Te and Ne-Te lasers a thermal-energy charge-transfer process is thought to be the dominant excitation mechanism. This research will examine this hypothesis and obtain a quantitative measure of several of the charge-transfer cross sections: Investigations will also be carried out on Penning reactions, the individual charge-transfer cross section, and measurements that can provide fundamental experimental data on the output channels of thermal energy charge-transfer reactions as a function of: energy defect delta E, total angular momentum and parent species. Individual charge-transfer cross sections for all three systems, once obtained, will be compared with theoretical predictions. The research will determine quantitatively the importance of high-lying Rydberg states to the observation that thermal energy charge-transfer cross sections are observed to have a maximum about 2000-4000/cm.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0009, GENERALIZED GEOMETRIC PROGRAMMING WITH APPLICATIONS
E.L. PETERSON, Northwestern University, School of Technology, *Evanston, Illinois* 60201 (DF046350; AF-AFOSR-3134-77)

AF function - the improved use of scarce resources, including funds, manpower, and equipment is an all-pervading responsibility in the Air Force. Deficiency - the best allocation of resources is often an extremely difficult goal to achieve, especially when there are a number of imposed constraints. Such problems arise in structural mechanics, engine/aircraft design, scheduling machine shop jobs, and routing transport vehicles. Objective - to extend the theory of geometric programming, a type of optimization theory that is only 15 years old and which has found a large number of useful applications. How work contributes - research in this area leads to better methods--computationally faster or capable of treating larger problems--which in turn means higher cost effectiveness.

The theory, whose foundations rest largely on the pioneering work of the proposer, will be extended and applied to problem areas of the following sorts--1) optimal location of new facilities relative to existing facilities, 2) nonlinear multicommodity traffic flow, 3) electric and hydraulic networks, and 4) nonlinear multicommodity storage and/or transshipment.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NM, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0010, ELECTRON BEAM CONTROLLED GAS LASERS
T.A. DETEMPLE, Univ. of Illinois, School of Engineering, *Urbana, Illinois* 61801 (ENG 75-21515)

This research is aimed at the investigation of gas lasers excited in an ionizer-sustainer mode of discharge. The primary goals of the research are to use an electron beam controlled gas discharge to: a) investigate the characteristics of infrared lasers operating on vibrational transitions in a non-self-sustained mode, and b) to investigate the characteristics of electronic transition lasers operating at high pressures in a self-sustained mode. In addition to studying laser action, an evaluation will be made of the use of the ionizer-sustainer technique as a means of obtaining higher power from known laser systems and as a means of exploring new laser systems.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0011, DEVICE STRUCTURE AND MATERIALS EVALUATION
N.E. PICKERING, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF901210)

AF function - communications and surveillance. Deficiency - solid-state devices operating at microwave frequencies in current Air Force systems are unreliable. Objective - the goal of this work is to determine the effect of defect structure and surface morphology on device, components, and system reliability under both active and passive operating conditions. How research contributes - this research will result in an understanding of the failure mechanisms occuring in microwave devices and thereby lead to greater system reliability.

We will use the scanning electron microscope (SEM) with its associated attachments such as hot stage, x-ray analyzer, and active mode testing apparatus to investigate surface structure and defects. The use of new interpretive techniques including Coates patterns or active emission testing will help in the evaluation of materials and devices. the analysis of devices will be done in a step-wise manner during device processing, so that the introduction of defects or inclusions can be related to a particular stage of device fabrication.

ADDENDA: Supporting agency address is: Rome Air Development Center ETS, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0012, MEASUREMENT OF KINETIC RATES FOR CARBON MONOXIDE LASER SYSTEMS
J.W. RICH, Calspan Corporation, *Buffalo, New York* 14221 (DF046450; F49620-77-C-0020)

AF function - the electrically excited carbon monoxide laser is one of the most efficient coherent radiation sources known. It has the development potential to cover a wide wavelength region in the infrared and the possibility of wide band-width tunability. These advantages and development potential have led to studies of the use of CO lasers in the Air Force High-Energy Laser and Infrared Avionics Programs. Opportunity - extensive laser kinetic modeling computer codes have been developed to predict laser power, efficiency, and spectral distribution as functions of operating parameters. Such codes are valuable for predicting the performance of proposed laser systems. However, the predictive capability requires accurate knowledge of certain parameters that must be obtained experimentally. This program will provide such data. Objective - this program will provide measurements of optical cross sections and of gas-phase kinetic rates of importance for the performance prediction of carbon monoxide lasers being developed for the Air Force. Contributions - optical cross sections and gas phase kinetic rates have been measured in the last few years. However, there are additional rate data required as the emphasis on CO laser development moves into new areas.

Optical cross sections and energy transfer rates in CO laser systems will be measured in a high-pressure, flowing gas cell in which CO is optically pumped by a high-power CW CO laser. It is important to measure the following quantities: (a) the Einstein a coefficients of the infrared fundamental and first overtone of the vibrational states of the ground electronic state, (b) optical broadening cross sections and linewidths, (c) v-v rates for CO-CO for excited states up to v equals 30, (d) v-t rates for CO-He and CO-Ar up to v equals 30.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NP, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0013, STATISTICAL INFORMATION PROCESSING TECHNIQUES FOR REMOTE SENSING DATA

D. KAZAKOS, State University of New York, School of Engin. & Appl. Sci., *Buffalo, New York* 14214 (ENG76-20295)

The problem of reduction of remotely sensed data with concurrent preservation of the interesting information is one of the main themes of this research plus developing computationally simple performance bound and of exploiting them for data reduction. Increased exploitation of the statistical structure of the data is advocated, which ordinarily would cause increased storage and computational load. The simultaneous consideration of data reduction algorithms and computationally simple performance bounds will alleviate this problem. Therefore, improved performance using the same computer resources will be the overall result of the research. The methods, when fully developed, will greatly enhance the operational capabilities of present and future remote sensing systems with automated data processing.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0014, NEW MEMORY DEVICE STRUCTURES

G.A. HARTSELL, Texas Instruments Incorporated, *Dallas, Texas* 75222 (DF096850; F33615-74-C-1054)

A serial memory device is required which can store digital or analog information after having survived large radiation doses and which is comparable to, but significantly cheaper than the one on conventional approaches which use radiation-hardened MOS devices or acoustic surface wave devices. High reliability, small size, and low power dissipation are also desired, however, non-volatility is not an essential requirement. An initial memory configuration of 64 bits will be constructed, with expansion to larger arrays as the technology permits. This work supports TN-ASD-27-69-51(1) and TN-SAMSO-0901-72-20.

Several semiconductor memory technologies exist or have recently been developed for this application and other new technologies will likely be proposed before initiation of this effort. The most promising of these new technologies will be explored. A 64-bit serial register will be constructed together with sufficient test structures to assess various cost/performance trade-offs. Maximum effort will be made to utilize existing semiconductor manufacturing processes.

ADDENDA: Supporting agency address is: AF Avionics Laboratory DHE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0015, RESTORATION OF AIR-GROUND IMAGES BY REMOVING ATMOSPHERIC PHASE ABERRATIONS

J.R. BENTON, U.S. Army, Coherent Optics Center, *Fort Belvoir, Virginia* 22060 (DA0M8063)

The objective is to investigate the feasibility of applying a new approach to image processing which improves effective resolution by minimizing atmospheric phase effects. This technique has application to image restoration problems where data are obtained through aberrating mediums. This imaging may result from satellite or star tracking.

The approach is to record the image data (air-to-ground or ground-to-air) and to use a heterodyned optical correlator configuration to rapidly obtain an autocorrelation profile of the scene. Computer processing of the image data and autocorrelation data will be performed, and is expected to yield a correction estimator which can be applied to separate the phase errors and yield an improved image. A report of this work unit will be written.

ADDENDA: Supporting agency address is: OCE ETL Center for Coherent Optics, RI, Ft Belvoir, Va 22060

SUPPORTED BY U.S. Dept. of Defense, Army

4.0016, AEROSOL LASER PASSIVE COUNTERMEASURES CONCEPTUAL DEVELOPMENT

K. BRENTMAN, Boeing Company, *Seattle, Washington* 98108 (DA0D4089; DAAJ02-77-C-0005)

Investigate aerosol/smoke systems compatible with the AH-1 helicopter that have the potential of providing laser designator/visual countermeasure capability.

Phase I will identify and document SOA with respect to aerosol/smoke formulations, dispensing systems and delivery systems responsive to mission requirements. Phase II will involve the conceptual development of candidate countermeasures systems.

ADDENDA: Supporting agency address is: AVSCOM Air Mobility R D Lab, Eustis Dir, Ft Eustis, VA 23604

SUPPORTED BY U.S. Dept. of Defense, Army

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, STUDIES OF ICE CRYSTAL FORMATION IN THE ARCTIC CLEAR SKY BY MEANS OF AIRPLANE OBSERVATIONS

T. OHTAKE, Univ. of Alaska, Geophysical Institute, *Fairbanks, Alaska* 99701 (DPP76-21594)

The spatial extent of ice crystal clouds will be measured in March, 1977, off the coast of Barrow, Alaska. These measurements will be made with an aircraft instrumented for cloud physics research and with ground-based instrumentation. In conjunction with these ice crystal observations, measurements of aerosols and arctic haze layers also will be made.

SUPPORTED BY U.S. National Science Foundation, Div. of Polar Programs

5.0002, BLACK MESA, FOUR CORNERS

T.N. KARLSTROM, U.S. Dept. of the Interior, Geological Survey, *Flagstaff, Arizona* 86001 (9530-01552)

States to which project pertains: Arizona at present, small parts of Utah, Colorado and New Mexico later on.

Two main objectives: 1. Based on current data, a provisional time-stratigraphic model of the Cenozoic geologic history of the region has been developed which can be directly related to changing physical environments in the Southwest. Field mapping is directed towards further testing and refinement of this paleoenvironmental model by continued dating of surgical deposits by fossils, C-14, K/Ar, tree-rings, paleomagnetism, and buried

archaeological structures. 2. Continued experimentation with computer-enhanced ERTS multispectral imagery as a potential tool for rapid photogeologic mapping of surficial deposits according to genesis (fluvial, eolian, colluvial) and age. Three sites have been selected in which multispectral combinations at various scales will be tested in developing the best combination of color ratios and scale for delineation and portrayal of surficial geology map units on Ship Rock Quadrangles. Compilations, tested against conventional aerial photos and field observations, will be first completed in the Marble Canyon Quadrangle, Arizona.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0003, REFURBISHED AND MODIFIED HHS SENSOR
A. MCDIVOTT, Rockwell International Corp., *Anaheim, California* 92803 (DF248750; F19628-77-C-0049)

AF function - target detection. Deficiency - the capability of infrared sensors to acquire, detect and track targets against the natural background is significantly affected by the characteristics of this celestial background. Objective - to obtain a sensor capable of making the required celestial background measurements from a rocket probe. How research contributes - the information obtained by using this sensor is required for design specifications for Air Force satellite systems.

The HHS sensor will be refurbished and modified to fly on a rocket payload to obtain the required measurements for the SAMSO Space Defense Program.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory OP, Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense, Air Force

5.0004, BALLOON ELECTRIC FIELD MEASUREMENTS DURING THE INTERNATIONAL MAGNETOSPHERIC STUDY
F.S. MOZER, Univ. of California, School of Letters & Science, *Berkeley, California* 94720 (ATM76-22278)

This grant will continue the support of University of California balloon measurements of ionospheric and atmospheric electric fields during the International Magnetospheric Study (IMS). The grant will be used for analyses of existing data, for measurements of electric fields parallel to the geomagnetic field, and for simultaneous worldwide observations of electric fields and auroral zone parameters. These experiments will be performed in conjunction with observations of electric fields on the S3-3, GEOS, and ISEE-A satellites.

Existing data to be analyzed in the program were obtained from simultaneous observations at six balloon launch sites during four successive days in August, 1974, in a collaboration involving scientists from six countries.

The parallel electric field measurement program will use a large balloon flown from Thompson, Canada, at an altitude of about 140,000 feet. At this altitude electric fields of atmospheric origin will be small enough to allow measurements of vertical ionospheric fields whose origin lies in the E- or F-region. Ionospheric fields will be separated from those of atmospheric origin by their different altitude dependencies and by comparison of measurements on two payloads flown on the same balloon but that are separated by a vertical distance of about six kilometers.

The worldwide balloon electric field and auroral zone parameters experiment will be performed in August, 1978, at the peak of the IMS program. It will require a major collaboration of scientists throughout the world during a four-day interval when ionospheric field data will be obtained from as many as 10 balloon sites, 5 radar sites, and 3 satellites. This program will thus be an expansion of a similar but smaller-scale program performed in August, 1974.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0005, DOPPLER RADAR SIGNALS FROM TORNADIC STORMS
D.S. ZRNIC, Calif. State Univ. & Colleges, School of Engineering, *Northridge, California* 91324 (ATM76-22974)

A technique is proposed to determine tornado characteristics (wind speed, diameter, etc.) from power spectra obtained from NSSL (National Severe Storms Laboratory) Doppler radars. Specific objectives include: (1) an assessment of the effects of a realistic pulse-volume weighting in range on the model tornado spectra, (2) a search for tornado spectral signatures, and (3) an attempt to identify tornado parameters simultaneously from dual radar data.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0006, NAVY ENVIRONMENT - REMOTE SYNOPTIC MEASUREMENT OF SURFACE CIRCULATION
J.D. ISAACS, Univ. of California, Inst. of Marine Resources, *San Diego, California* 92038 (DN775038; N00014-76-C-1103)

The objective of this research is to develop a method for the remote synoptic measurement of ocean surface circulation. The remote, near-real time measurement of surface currents would be a highly valuable contribution in the planning and execution of Navy-Marine Corps operations in coastal waters.

This method relies on wavelength measurements of two distinct trains of gravity waves as they propagate through regions where surface circulation is to be determined. The method proposed here is basically simple, as it utilizes only wavelength measurements of two wave trains. the wavelength data will be determined from vertical aerial photographs. The photographs will be analyzed by optical data processing techniques to obtain the wavelength information from the two separate wave-trains propagating simultaneously. The waves will be generated by two wave generators of controlled frequency. The experimental work will include model simulation in a small basin located outdoors to simulate real illumination conditions for photography, and surface circulation measurement in a lagoon of a known and simple circulation. The results of these experiments will be evaluated for their application to surface circulation detection and measurement in harbors and larger bodies of water, both those accessible to ground measurements and otherwise; and the utility of local wind or ships' waves for such analysis.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense, Navy

5.0007, URANIUM RESOURCES PROSPECTING - AIRBORNE GAMMA-RAY SPECTROMETRY
A.G. DARNLEY, Geological Survey of Canada, *Ottawa, Ontario, Canada* (OEPD 3.2.1.1)

OBJECTIVE: To ensure all potential resource areas in Canada are known and delineated in order to facilitate the discovery and assessment of new deposits, and to improve methodology of exploration techniques.

WORK: Airborne gamma-ray spectrometry surveys of potential uraniferous resource areas in Canada using high-sensitivity equipment. This is a 10-year program. Approximately 150 thousand square miles will be covered annually. Reference: Uranium Exploration '76. Geol. Surv. Can. Paper 76-26.

SUPPORTED BY Dept. of Energy Mines & Resources

5.0008, URANIUM RESOURCES PROSPECTING - NATIONAL GEOCHEMICAL RECONNAISSANCE
A.G. DARNLEY, Geological Survey of Canada, *Ottawa, Ontario, Canada* (OERD 3.2.1.2)

OBJECTIVE: To ensure all potential resource areas in Canada are known and delineated in order to faciliate the discovery and assessment of new deposits, and to improve methodology of exploration techniques.

WORK: Airborne geochemical reconnaissance of selected potential uraniferous resource areas in Canada. Geochemical surveys in areas unsuited for airborne surveys, in areas where geochemical methods are more effective than radiometric methods and in areas of above average potential. This is a 10 year program. Reference: Uranium Exploration '75. Geol. Surv. Can. Paper 76-26.

SUPPORTED BY Dept. of Energy Mines & Resources

5.0009, SIPLE RADAR AURORAL STUDIES
B.B. BALSLEY, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (DPP76-23750)

An auroral radar will be set up at Siple Station, Antarctica, and used to obtain amplitude and spectra data on radar aurora during 1977. This data will be used to study the characteristics of electron density irregularities in the auroral E-region that are closely associated with the auroral electrojet and the associated ionospheric/magnetospheric electric fields.

Logistics support will be required for two scientists to carry on work at Siple Station during the austral summers of 1976-77 and 1977-78.

SUPPORTED BY U.S. National Science Foundation, Div. of Polar Programs

5.0010, LIDAR MEASUREMENT OF AEROSOLS
V.E. DERR, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (BAA7 09 30)

PROJECT OBJECTIVE: Develop lidar techniques for measuring particulate pollutants from energy production and their transport and dispersion processes.

CURRENT YEAR PLAN: Construct, test and evaluate polarization-sensitive aerosol lidar and measure stack emission vs. natural aerosols by polarization lidar.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development

5.0011, STRATOSPHERIC WATER VAPOR MEASUREMENTS
A.L. SCHMELTEKOPF, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (8DJ42082)

PROJECT OBJECTIVE: Design and construct instrumentation which can be carried into the stratosphere on a balloon which will measure the density of water vapor at stratospheric altitudes. This instrument will observe fluorescence from excited OH radicals produced by photodissociation of H2O.

CURRENT YEAR PLAN: Develop a vacuum UV light source suitable for the photodissociation. Demonstrate the workability of the technique in a laboratory simulation. Construct and test an instrument to make stratospheric measurements at night. Construct and test an instrument to make stratospheric measurements at any time.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

5.0012, WATERSPOUT VELOCITY
R. SCHWIESOW, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (RAA7 18 33)

PROJECT OBJECTIVE: To interpret waterspout velocity structure data. To measure flow fields associated with the diffusion of atmospheric contaminants.

CURRENT YEAR PLAN: Digitize raw data taken during FY76 on waterspouts. Analyze reduced velocity spectral data and compare to various vortex models. Participate in vertical diffusion experiment with ARL in Idaho Falls.

PROGRESS REPORT: Airborne Doppler lidar system was designed, built, tested and installed in sponsor-supplied aircraft. Velocity spectral data was obtained from various levels of a number of waterspouts in the Key West, Florida, area.

SUPPORTED BY U.S. Nuclear Regulatory Commission, Div. of Reactor Safety Research

5.0013, GEOLOGIC INVESTIGATIONS OF SURFACE THERMAL MANIFESTATIONS
J.D. FRIEDMAN, U.S. Dept. of the Interior, Geological Survey, *Denver, Colorado* 80225 (9790-01704)

STATES TO WHICH PROJECT PERTAINS: California, primarily; applications in Washington, Oregon and Hawaii, etc.

Under the auspices of a comprehensive geothermal remote-sensing project, the present project is designed primarily to test and evaluate aerial, and where suitable, satellite infrared scanning techniques and concomitant ground observations in geothermal studies, both as reconnaissance and mapping tools. The goal of the project is (1) to utilize quantitative thermal image data in conjunction with digital computer processing to record time-dependent changes in thermal emission (i.e., temperature, radiance, and near-surface anomalous heat flow) from surface manifestations in geothermal areas, (2) to analyze the planimetric distribution of anomalies in relation to structure and geophysical anomalies and (3) ultimately to determine radiative and other energy loss from the terrestrial surface in geothermal areas. In application of these techniques to volcanic systems, the goal is similar, and in addition, we shall estimate minimum thermal energy yields during response periods of volcanoes, as a base of reference for comparison with future periods of activity and as an aid in understanding the overall energy budget of volcanic systems.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0014, REMOTE SENSING GEOTHERMAL
K. WATSON, U.S. Dept. of the Interior, Geological Survey, *Denver, Colorado* 80225 (9790-00922)

To extend the use of theoretical thermal model to more complex geological situations including topographic and surface roughness effects, to develop the computer methodology for registration to aircraft images acquired at different times in diurnal cycle and to complete aircraft-scanner modifications for navigation, spectral response and multichannel digitizing.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0015, IMPACT OF CONDITIONING ON POWER PLANT EMISSIONS THROUGH CONTROLLED AIRBORNE SAMPLING
R.E. WILLIAMS, Univ. of Denver, Denver Research Institute, *Denver, Colorado* 80210 (R804829 01)

OBJECTIVE: To explore the feasibility of using a captive balloon, capable of carrying an ultra lightweight sampling package, to ascertain the concentration and composition of certain solid, liquid, and gaseous emissions from a fossil fuel power plant. It is anticipated that this sampling scheme would be used to quantify the impact of conditioning on emissions as well as extending mass balance studies and investigating the primary versus secondary aerosol content of stack plumes in areas where periods of rather stable horizontal plume conditions occurs.

TECHNIQUE: A tethered balloon with multiple, sequential particulate samplers will be used to cross-section and profile an isolated power plant plume collecting only solid particulates during this study. Particulate composition and size distribution will be compared with stack samples and plant operating conditions.

RELEVANCE: The fate of emissions from stacks is not well understood. Attempts using aircraft are not feasible at low flying altitudes and in proximity to the power plant stack because of the poor spatial resolution (aircraft velocity), and for safety reasons. Optical techniques, such as the transmissometer, give no meaningful data as to changes in plume composition. An in situ sampler can lead to an understanding of how plant operations, e.g., addition of H2SO4, lime, etc., can alter emissions with time.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development

5.0016, RESEARCH OF THE SHUTTLE-ASSISTED HYDROLOGY PROGRAM
P. BOCK, Univ. of Connecticut, School of Engineering, *Storrs, Connecticut* 06268 (NSG 5179)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

5.0017, MIXED LAYERS OVER THE OCEAN SURFACE
E.B. KRAUS, Univ. of Miami, School of Marine & Atm. Sci., *Miami, Florida* 33149 (ATM75-22940 A01)

The morphology of marine mixed layers (that is, the three-dimensional pattern of flows which do produce mixing under and across inversions) has been the subject of hypotheses and of numerical simulations, but it has never been observed except by point observations of one-dimensional traverses.

An objective of this research is to assess this three-dimensional pattern locally, through Doppler radar observations of artificial targets (chaff) in a ten-square-kilometer area over the Gulf Stream in the Straits of Florida. A dual Doppler radar system and ancillary equipment which can record and display the Cartesian velocity coordinates at 300 meter grid intervals is available for this purpose. It is planned to complement and compare the radar observations with aircraft traverses which will also involve flux determinations and with traverses by a shipborne acoustic sounder.

While this observational program is being prepared and during the period when there are no inversions locally, we plan to continue ongoing theoretical studies concerned with the reason for the steadiness of the trades, with the absorption of planetary waves in surface mixed layer and with the modelling and prediction of the oceanic mixed layer.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0018, ATMOSPHERIC CIRCULATION SYSTEMS IN THE GATE AREA

C.L. JORDAN, State University of Fla. Sys., School of Arts & Sciences, *Tallahassee, Florida* 32306 (ATM76-14211)

The objective of this research is to investigate the structure of lower tropospheric disturbances over West Africa during the GARP Atlantic Tropical Experiment (GATE) period and their modification as they travel westward over the eastern Atlantic. A comprehensive set of analyses on the synoptic scale will be prepared for several levels between the surface and 500 mb for selected periods during the GATE period. Case studies will be done, and results of other investigators will be used, in assessing the influence of smaller-scale systems on synoptic-scale features, especially in the GATE B-scale area. Initially, primary emphasis of the analysis program will be on kinematics, but later analyses will deal with thermal structure and with cloud and weather distributions.

The basic analysis activity is to be closely coordinated with other GATE research programs. Cooperation of this type reduces the amount of duplication and ensures the incorporation of results of NCAR small-scale studies involving the research aircraft and boundary layer systems.

The analysis program will be a continuing activity during the first grant year since more complete and more accurate sets of data will become available from the data processing centers. The problems of data assimilation are particularly severe on the smaller scale where it is difficult in many cases to fit the non-synoptic data from ships, aircraft and satellites) into the synoptic scale analysis.

The set of synoptic charts to be done in this program will facilitate the preparation of such auxiliary materials as statistical features of the wave disturbances and track charts for individual vortices at the several levels.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0019, INFRARED FLUX IN THE EARTH'S ATMOSPHERE

L.D. KAPLAN, Univ. of Chicago, School of Physical Sciences, *Chicago, Illinois* 60637 (ATM76-81027)

The purpose of this research is to continue to develop methods for determining the three-dimensional distribution of flux of infrared radiation in the earth's atmosphere and its relation to the temperature, pressure, composition, cloud and snow cover, and aerosol fields. Emphasis will be placed on obtaining maximum computational speed compatible with the accuracy requirements of general circulation and numerical weather prediction models. The role of absorption of radiation by ozone, clouds, and aerosols in the tropospheric circulation will be investigated with special attention given to radiative effects on the thermal structure and dynamics during periods of a few days to a few weeks. Continued work on the determination of the characteristics of a remote sensing system to obtain high vertical resolution in retrievals of temperature and water vapor distributions will also be performed under this grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0020, A DOPPLER RADAR/AIRCRAFT STUDY OF PLANETARY BOUNDARY LAYER GROWTH

P.H. HILDEBRAND, Univ. of Illinois, Graduate School, *Urbana. Illinois* 61801 (ATM76-24236)

An experimental study of planetary boundary layer (PBL) growth dynamics is proposed. The experiment will use gust-probe equipped aircraft and Doppler radars to measure the temperature, humidity and air motion characteristics of the PBL several times a day on several days. The days will be chosen so as to minimize the disturbing effects of fronts or deep convection.

An aircraft will be used to drop radar signal reflecting chaff and to measure the means and fluctuations of temperature, humidity, and momentum as a function of height above ground. These data will be used to evaluate the turbulent energy balance equation for the PBL and to calculate the spectra, cospectra, and fluxes of heat, humidity and momentum. These calculations will be used to evaluate the relative importance of various sources and sinks of energy within the growing PBL. The results of currently existing numerical PBL models will be compared with this experiment.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0021, LAND RESOURCES INVENTORY AND INFORMATION RETRIEVAL SYSTEM FOR WESTERN ILLINOIS

J.A. NELSON, Univ. of Illinois, Agric. Experiment Station, *Urbana, Illinois* 61801 (0069401; ILLU-01-0350)

OBJECTIVE: Inventory land resources in 10-county Title V project area at a scale meaningful for local decision-making; determine suitability of land for alternative uses (agriculture, conservation or preservation, recreation and open space, and urbanization); deliver a usable system of factual and interpretive data to provide local officials with information useful in land-use decisions.

APPROACH: Data to be gathered by field groundwork, low-level aerial photography, high-level photography, and remotely sensed imagery (ERTS). Preparation of maps and tabular information with descriptive narrative. Western Illinois University is a cooperating institution.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, Illinois

5.0022, ACTIVE AND PASSIVE SYSTEMS FOR WATER QUALITY MONITORING

K.H. LENZEN, Univ. of Kansas, School of Engineering, *Lawrence, Kansas* 66044 (NSG 1422)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

5.0023, RESOURCE AND RADIOACTIVITY SURVEY IN ANTARCTICA BY AIRBORNE GAMMA-RAY SPECTROMETRY

E.J. ZELLER, Univ. of Kansas, School of Liberal Arts & Sci., *Lawrence, Kansas* 66045 (DPP76-23441)

The University of Kansas will continue a survey of radioactivity in Antarctica. A primary aim of this research project is the understanding of the distribution and concentration of radioactive elements in the different rock strata and in different tectonic environments. The research will also be important for the evaluation of ice-free areas as potential sources of radioactive-energy sources. During the initial phase of the project, special equipment was purchased, modified, tested, and adapated to use in the field with equipment already available at the University of Kansas.

Field research during the 1976-77 field season will be in the ice-free areas of the McMurdo region, where reference ground lines will be surveyed for radioactivity and the instruments then calibrated from the air over the reference lines. During the 1977-78 field season, a reconnaissance aerial survey by helicopter, begun during 1976-77, will be completed of the ice-free areas in the McMurdo regions.

Three scientists from the University of Kansas will do field work in the McMurdo area, Antarctica, during the 1977-78 field season.

SUPPORTED BY U.S. National Science Foundation, Div. of Polar Programs

5.0024, CONVECTIVE CLOUD POPULATION SURVEY OF WESTERN KANSAS HIGH PLAINS

L.D. BARK, Kansas State University, Agric. Experiment Station, *Manhattan, Kansas* 66502 (0065387; KAN-05-369)

OBJECTIVE: Determine the monthly, seasonal, and total frequency distribution of the size of convective cloud systems occurring in the High Plains of Kansas. Determine the height distribution of these convective cloud systems so that the frequency distribution can be partitioned by cloud height as well as aerial size. Develop a methodology for use of existing radar data for providing a climatology of convective cloud systems in Kansas.

APPROACH: Analysis will be made of data from the Garden City WSR-57 radar for the period of peak convective activity during the year, April through September. Echo radii determinations will be made from the filmed record of the PPI scope. The echo size at the hour of first report will be used to estimate the frequency of distribution of cloud sizes following methods developed in Colorado. All convective cloud systems located within 125 nm of the radar site will be included.

PROGRESS: Filmed radar data from the Garden City installation were analyzed for the 18-month period April-September, 1972-74. Convective echoes were observed on 75% of the days in the period, 84% of the 10,658 echoes identified formed over the state, and the rest migrated into Kansas. More echoes were observed in the early season (April-June) than later in the season with a definite minimum in September. There appears to be a geographical difference in the number of echoes formed with a maximum in northwest Kansas and a minimum near the Oklahoma border. Seventy-seven percent of the echoes had an initial radius of less than 4 Km. Only 13% of these small echoes grew naturally to a size of over 4 Km radius. Clouds of this small size are often considered 'treatable' in weather modification activities. This means that 2/3 of the echo population is in the treatable category during their entire life span. Over 50% of the echoes formed between the hours of 12 noon and 6 p.m. CST. Thirty-five percent formed during the hours of darkness. Over 60% of the echoes classed as treatable persisted for a period of less than 1/4 were in existance for over 30 min. An attempt was made to identify the synoptic conditions under which echoes form. Cold frontal situations and upper-air troughs without surface features accounted for most of the echoes identified. (Text Abridged)

SUPPORTED BY Kansas State Government

5.0025, RESEARCH OF SOLAR ISOLATION AT THE EARTH SURFACE FROM CLOUD COVER

E.T. KANEMASU, Kansas State University, Agric. Experiment Station, *Manhattan, Kansas* 66502 (0070188; KAN-05-482)

OBJECTIVE: Relate meteorological satellite imagery to cloudiness and estimate solar radiation at the earth's surface.

APPROACH: A four-county area in Western Kansas is being instrumented with solarimeters and used as the test area. NOAA and GOES satellites will be used in the cloud analysis. Solar radiation, as assessed by satellite, will be used in an evapotranspiration model.

SUPPORTED BY Kansas State Government

5.0026, A MODEL FOR METHANE AND CARBON MONOXIDE INCORPORATING A TIME-VARYING WIND FIELD AND TROPOPAUSE HEIGHT

L.K. PETERS, Univ. of Kentucky, School of Engineering, *Lexington, Kentucky* 40506 (NSG 1424)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

5.0027, LABORATORY AND THEORETICAL RESEARCH ON CONVECTION AND RELATED PROBLEMS

R.R. LONG, Johns Hopkins University, School of Arts & Sciences, *Baltimore, Maryland* 21218 (ATM76-22284)

This is a proposal to extend current investigations on atmospheric convection for an additional two-year period. The present proposal emphasizes heavily experimental work to be done with a turbulent plane-Couette flow apparatus for studying turbulent convection with shear. This, of course, is the situation in the surface layer of the atmosphere under conditions of heating.

In recent years an apparently successful approach to the problem of the surface layer has been through the use of second-order moment equations in which the third-order moments are modelled in certain ways. This modelling is usually on an ad hoc basis and introduces a number of quantities which the authors regard as constants. These 'constants' may, however, vary with the various parameters of the flow and it is certainly advisible to be able to investigate this experimentally by studying flows such as that in the Couette flow apparatus. It is intended, then, to measure various quantities including mean and fluctuating temperatures and velocities to assess the various assumptions in these third-order theories. In addition to this experimental work, the principal investigator will conduct theoretical investigations as in the past, for example relation between the Nusselt number and the Rayleigh number. Such investigations may be very valuable in attempting to verify the accuracy of the various theories of turbulent convection. The evidence so far with respect to these theories is contradictory and additional work is necessary. One investigation is that of a turbulent plume above a heat source. Recent work indicates that this can be used to approach the theory of convection above a large surface.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0028, STUDIES OF SOLAR AND MAGNETOSPHERIC PARTICLES

S.M. KRIMIGIS, Johns Hopkins University, Applied Physics Laboratory, *Laurel, Maryland* 20810 (ATM76-81099)

This grant is for scientific studies of data on charged particle intensities, angular distributions, energy spectra, and compositions obtained with the Charged Particle Measurement Experiment built by The Johns Hopkins University Applied Physics Laboratory and carried aboard the NASA satellites IMP-7 and 8. Similar data from JHU/APL experiment on IMP-6 will be examined in conjunction with that from IMP-7 and 8. Data from other experiments on the same spacecraft will also be used on a cooperative basis with other investigators.

In general terms, the objectives of this study are to obtain new information and understanding of the electrodynamics and plasma physics of the terrestrial magnetosphere, interplanetary medium and the Sun. The specific studies will concern themselves with two areas: (a) The study of particle acceleration phenomena in the earth's magnetotail, with emphasis on plasma sheet and neutral sheet measurements of particle pitch angle distribution, charge, and energy spectra. Particular emphasis will be devoted to analysis of events from two or more closely spaced spacecraft. (b) A statistical and case-by-case study of the charge composition of solar particle emissions, particularly during active periods, and delineation of the dependence of composition on energy, flux level, location on the solar disk, spatial structure in the interplanetary medium, and interaction with the earth's magnetosphere.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0029, THUNDERSTORM FORECASTING FOR AVIATION PROJECT - SHORT-RANGE FORECASTING FOR AVIATION

M.A. ALAKA, U.S. Dept. of Commerce, Techniques Development Lab., *Silver Spring, Maryland* 20910 (RD5901)

TECHNICAL OBJECTIVE: To develop objective techniques for short-range (0-6 hours) prediction of thunderstorms and low-level wind shear for aviation.

APPROACH: 1. To apply relatively simple objective procedures, programmable on a minicomputer, for tracking and extrapolating the motion of digitized radar echoes associated with thunderstorms for a period of up to 2 hours. 2. To apply a combination of MOS and classical statistical techniques to predict thunderstorm occurrence 2-6 hours in advance. 3. To develop techniques for predicting low-level wind shear.

PROGRESS (July 1975 to October 1976): This project is the reimbursable portion of the short-range and very short-range forecasting (radar techniques) tasks of the Severe Long Storms Prediction Project No. 8C3781. Progress is reported there.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin., Systems Research & Development Service

5.0030, ASH CAN BALLOON SAMPLING PROGRAM ASH CAN GONDOLA TASK

P.T. SINTETOS, U.S. Dept. of Commerce, Equipment Development Lab., *Silver Spring, Maryland* 20910 (RFK206)

TECHNICAL OBJECTIVE: To provide Instrument Shop support (since 1970) to ARL's Ash Can Sampler Equipment project.

APPROACH: To fabricate gondolas with trapdoor assemblies and related equipment for ARL's upper air sampling program.

PROGRESS (JULY 1975 TO OCTOBER 1976): During FY 1976 (& 77), 42 gondolas were made for ARL. In addition, EDL designed and developed an upgraded door mechanism for the air sampling systems. EDL will continue to build various types (air injector, carbon, and direct flow sampler) of gondolas in FY 1977.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

5.0031, CLIMATIC CHAMBER TEST OF AN ICE ACCRETION MEASURING SYSTEM

P.I. TATTELMAN, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF249470)

AF function - engineering design. Deficiency - current icing information is inadequate to develop reliable engineering design criteria. Objective - determine the feasibility of taking objective observations of ice accretion. How development contributes - provides input to AF design of systems for which ice accretion at the earth's surface is critical.

The Rosemount Engineering Co., Minneapolis, MN, builds and markets ice detectors to detect ice formation in aircraft engines. Four detectors and a controller to operate them will be purchased from Rosemount. These will be linked with a recorder for our meteorological purposes. These detectors will then be tested in various orientations to determine the optimum arrangement of the sensors for measuring ice accretion. The testing will be accomplished in the 'All-Weather Room' of the Armament Development and Test Center at Eglin AFB. The detectors will be tested for a wide range of meteorological conditions to relate instrument ice detection to ice accretion on several sizes of metal rods and flat plates in varying orientations. This effort will require attendance of the work unit scientist during five weeks of testing at Eglin AFB. Data collected at the test facility will be summarized in report form to provide input on the manner in which ice is deposited on structural members of exposed systems. If it is determined that accurate measurements of ice accretion can be made using the Rosemount system, it will be referred to AWS for use as a network instrument for the collection of ice accretion data. This would fulfill AWS technical need 2-76. The final report will include recommendations on use and deployment. Data collection will be done by the AWS after termination of the work unit. Data collected will be used by AFGL at some future time to develop climatologies of ice accretion for design.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory LY, Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense, Air Force

5.0032, IONOSPHERIC PLASMA TRANSPORT AT HIGH LATITUDES

M. MENDILLO, Boston University, Graduate School, *Boston, Massachusetts* 02215 (DF248550; F19628-77-C-0019)

AF function - surveillance, communication, navigation, ionosphere and magnetosphere modelling. Deficiency - inadequate knowledge of plasma motions and the boundaries of trough and cusp precipitation regions as they respond to geophysical changes degrades capability of AF navigation and communications systems. Objective - development of computer codes which allow modelling of response of plasmapause, cusp and trough poleward wall to changes in geophysical conditions. Compare these theoretical results with satellite data. How research contributes - provides improved capability of forecasting shifts of ionospheric regions such as the cusp and trough region as they respond to geophysical changes. These shifts severely deviate ray paths of Air Force navigation and surveillance systems including DSCS, AF SAT COM, 414l, and their improved prediction is urgently needed.

Study and apply computational techniques to modelling of plasma dynamics for calculations of boundary and dynamical responses to geophysical changes.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory PH, L G Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense, Air Force

5.0033, EXPERIMENTAL AND THEORETICAL AIRGLOW STUDIES

A.F. NAGY, Univ. of Michigan, School of Engineering, *Ann Arbor, Michigan* 48106 (ATM75-17344 A02)

This grant is for the second increment of a 31-month continuing grant. The work has been related to high-resolution spectroscopic observations of natural atmospheric optical emissions carried out with the facilities of the Michigan Airglow Observatory. The Michigan Airglow Observatory was constructed under the National Science Foundation Facilities Grant GA-788 in 1967/68 and has since been improved under succeeding NSF grants. At the present time primary operational equipment consists of a six-inch Fabry-Perot interferometer, a four-channel tilting filter photometer, a scanning sector photometer and a single-channel photometer used in conjunction with the interferometer. These instruments are, generally, housed in the Michigan Airglow Observatory (MAO) which contains the multiplexing and digital recording systems.

The Observatory is used to study a wide range of atmospheric problems. One of the most important studies is that related to the atmospheric winds. The Doppler shifted emission lines are used to determine winds in a nearly inaccessible region. Similar measurements of lines originating from ionic species are used to deduce electric fields. Theoretical research interpreting these data is also supported by this grant.

Satisfactory progress has been made in the first (7-month) increment.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0034, OPERATION OF DETECTORS AT SIPLE STATION AND ROBERVAL, QUEBEC AND INTERPRETATION OF OBSERVATIONS

L.J. CAHILL, Univ. of Minnesota, Space Science Center, *Minneapolis, Minnesota* 55455 (DPP76-23749)

Search-coil magnetometers will be operated at the geomagnetically conjugate stations at Siple, Antarctica, and Roberval, Quebec, Canada, which are ideally situated for micropulsation studies in that they are 'quiet sites' and are at magnetic latitudes well-situated for exploration of the plasmapause region of the earth's magnetosphere.

The micropulsation data, obtained with the search-coil magnetometers at these sites along with data obtained by other ground-based passive and active techniques and by satellites, will be used to study (1) the conjugacy and polarization of micropulsation signals, (2) the propagation of signals through the ionosphere under varying seasonal, solar and local time conditions, and (3) the dispersive properties of the magnetospheric medium.

The primary objective of this research is to gain a better understanding of micropulsation dispersion so that it may be used as a tool for diagnostic studies of coupling between the magnetosphere and the ionosphere. A secondary objective is to reconcile the difference between ULF and VLF measurements of plasmaspheric electron density distributions.

Field support is required for one scientist at Siple Station during the austral summer of 1977/78. Stanford Winter-Over personnel will operate the equipment during the austral winter.

SUPPORTED BY U.S. National Science Foundation, Div. of Polar Programs

5.0035, REMOTE-SENSING TECHNIQUES FOR SEEPAGE DETECTION

W.K. DORNBUSCH, U.S. Army, Waterways Experiment Station, *Vicksburg, Mississippi* 39180 (31372)

OBJECTIVES: To develop a remote-sensing methodology for the expedient detection of seepage through and under levee systems during high flood stages. The methodology will enable identification of seepage locations through computer processing of remotely sensed data, permitting initiation of earliest possible remedial operations thereby minimizing the possibility of potentially disastrous seepage damage.

GENERAL APPROACH: Initial effort to address the problem of seepage along main stem Mississippi River levees. General sites selected on the basis of historical data collected during recent floods including both field and remotely sensed data. Recognition criteria for the various seepage sites will be developed from both manual and electronic examination of remotely sensed data acquired during high river stages. Diagnostic signatures will be generated based on variations in reflectance and emissive characteristics of seepage as contrasted with the levee background. Imageries examined during the study are to include visible and infrared photography and thermal infrared imagery. Specific seepage locations will be selected during high flood stages and detailed measurements of such critical parameters as soil and water temperature, depth to water table, soil moisture content, soil type, and meteorological variations will be obtained. Detailed investigations of lithology and structure will be made of the general area where it is necessary to relate seepage to underground conditions. Remote sensing missions will be formulated as determined optimum for the detection of surface and subsurface seepage. The missions will be planned for a time and date that will take advantage of desired solar, meteorological, and ground conditions whenever possible. Ground data will be taken simultaneously with the mission overflights measuring the previously cited parameters with instrumentation selected to provide the degree of accuracy required to enable correlation of the ground data with the remotely sensed data. The final product of the investigation will be a methodology which will be submitted in reported form to OCE and to Division offices. The contents of the report will include the following topics: (a) sources of pertinent data (geologic, hydrologic, remote sensing); (b) evaluation and selection of remote sensors; (c) selection of suitable organization with hardware and/or software capabilities; (d) mission planning. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Army, Corps of Engineers

5.0036, MIGRATION AND SEASONAL MOVEMENTS OF THE SPOTTED BEAR ELK HERD

C.A. SIMMONS, Univ. of Montana, School of Forestry, *Missoula, Montana* 59801 (0065997; MONZ-C03)

OBJECTIVE: Determine the migration and seasonal movements of elk that use the Spotted Bear Forested winter range. The area of interest is the Spotted Bear Forested planning unit, Flathead National Forest, and information collected may aid in forest land use planning.

APPROACH: Trap and radio tag elk on winter range and follow their movements through spring, summer and fall back to their winter range. Most tracking will be done by aircraft at least once a week.

SUPPORTED BY Montana State Government

5.0037, CHANGES OF SNOW AND ICE FIELDS IN TIME

G.J. KUKLA, Columbia University, Lamont Doherty Geolog. Observ., *Palisades, New York* 10964 (ATM76-01062 A01)

The objectives of this research are to study the seasonal and interannual variation of snow and pack-ice cover in both hemispheres, to assess its impact on the earth's heat budget, and to investigate its role in the mechanism of climate change.

The information that will be generated includes the following: (1) Weekly and bi-monthly charts of snow and pack-ice fields for the interval 1967-1976, based on existing NOAA and NASA maps and supplemented with additional satellite, naval, and aerial reconnaissance data will be prepared; (2) Time series of cryospheric climatic indices S and q for individual geographic areas in both hemispheres will be produced. Snow index S represents the extent of snow and ice in square km, Absorption Index q represents the amount of radiation which would be absorbed by the surface under a cloud-free atmosphere. Indices will be analyzed on a global basis for the 1967-1976 interval. (3) Time series of Open Water Index w showing the proportion of open water to ice cover in pack-ice fields will be done on a weekly and bi-monthly basis for the 1967-1976 interval. (4) Time series of melting Index m representing the amount of latent heat needed to melt accumulated snow and ice for 1974-1975.

This grant is a renewal of NSF Grant ATM76-01062.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0038, STUDY OF CHARACTERISTICS OF POLAR CAP AURORA IN DMSP IMAGES FROM 1972-1976

M.S. GUSSENHOVEN, Webb Associates Incorporated, *Yellow Springs, Ohio* 45387 (DF047370; F49620-77-C-0050)

AF function - communication, surveillance, and detection systems operating in and through the high-latitude ionosphere and magnetosphere are influenced by disturbances in the plasma medium resulting from energy deposition from the solar wind. Deficiency - there is no universally accepted theory of the reconnection process between the geomagnetic and interplanetary fields that occurs as the solar wind plasma is convected past the earth and of the attendant particle entry and acceleration mechanisms. Objective - the clarification of the nature, occurrence, and dynamics of polar cap aurora will provide an understanding of ionospheric and magnetospheric processes. Contribution - an understanding of the polar cap aurora will aid in monitoring and predicting magnetospheric substorm development.

Using Air Force DMSP satellite images from 1972-1976 as the basic data set, information will be obtained on polar cap auroras to determine their spatial and temporal characteristics, current carrying capacity and their relationship to ionospheric and magnetospheric events.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NP, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

5.0039, A SURVEY OF GROUNDWATER HYDROLOGY OF HOBCAW BARONY

T.M. WILLIAMS, Clemson University, School of For. & Rec. Resour., *Clemson, South Carolina* 29631 (0071788; SCZ00505-FR)

OBJECTIVE: Determine the water table positions and the seasonal variation of the water table. Determine the extent and timing of tidal influence on water table position. Determine subsurface flow patterns and rates of subsurface flow. Identify areas with minimum hydrologic complexity that would be suitable for nutrient cycling experiments.

APPROACH: The position of the water table and its temporal and spatial variation will be monitored by a grid system of 20 recording wells and 25 non-recording wells across the 7,500-acre Hobcaw Forest. Tidal influence on the water table will be determined from the well measurements and on tidal recorders located in Winyah Bay and saltwater creeks of the Atlantic Ocean. Groundwater flow will be calculated from the surface geometry of the water table as determined from the well measurements and flow rates determined from a series of pumping wells surrounded by observation wells.

PROGRESS: A surficial drainage map of Hobcaw Barony has been prepared using color infrared photographs. This map has been extensively ground-checked and is a good representation of the surface water flow. The grid network of 20 recording and 25 nonrecording groundwater wells was installed by July 8, 1975. Since that date, weekly readings have been taken on all wells, and a continuous record has been obtained on the recording wells. Initial data show the groundwater flow patterns closely follow surface flow on the western side of the peninsula, while groundwater flow appears independent of surface patterns on the eastern side.

SUPPORTED BY South Carolina State Government

5.0040, COASTAL PLAINS GEOPHYSICAL COOPERATIVE
I. ZIETZ, U.S. Dept. of the Interior, Geological Survey, *Herndon, Virginia* 22092 (9730-01361)

STATES TO WHICH PROJECT PERTAINS: North Carolina, South Carolina, Georgia, Virginia, Florida.

By the end of FY 77, complete aeromagnetic and aeroradioactivity coverage of the Coastal Plain from Virginia to Georgia and part of Florida will be completed. A summary report, including regional aeromagnetic maps will accompany the report.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0041, A PHOTOMETRIC STUDY OF THE MID-LATITUDE AURORAL REGION DURING THE INTERNATIONAL MAGNETOSPHERIC STUDY (IMS)
L.L. SMITH, Battelle Memorial Institute, *Richland, Washington* 99352 (ATM75-16036 A01)

This grant funds the completion and initial operation of a chain of photometers for the International Magnetospheric Study. In particular, it funds: 1. The construction, installation, and operation of two mobile automatic scanning photometers (MASPs) and the installation and operation of a third MASP unit presently under construction through NSF grant ATM-7516036. 2. The reduction of the data and its distribution to the IMS data collection center. 3. Comparative analysis and morphological studies of the optical emission patterns over the large local time and latitudinal coverage available from the photometer chains, and 4. Correlative studies with the ISIS-II and AE satellite programs including triangulation analysis with ISIS-II photometric data, for density, electron temperature, and particle flux measurements.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0042, VERTICAL MASS TRANSPORTS IN GATE CLOUD CLUSTERS FROM GEOSTATIONARY SATELLITE DATA
D.W. MARTIN, Univ. of Wisconsin, Space Science & Engr. Center, *Madison, Wisconsin* 53706 (ATM76-16892)

The objective of the proposed research is the analysis of the primary data base of geostationary satellite images of the Global Atlantic Tropical Experiment (GATE) area which are archived at University of Wisconsin to: (1) Infer vertical transports of mass on meso- to synoptic-scales using wind fields derived from cloud tracers and time evolution of normalized cloud brightness; (2) Estimate adiabatic heating due to vertical motion within and outside clusters, using soundings and the vertical mass transports described in (1); (3) Identify the dynamic forcing factors contributing to cluster growth and decay, using wind, vorticity, divergence and thermodynamic data; and (4) Generate limited cluster related statistics on cloud populations for verification of transport and heating estimates, and for use in tropical numerical models.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0043, MEASUREMENT OF FLUOROCARBONS, NITROUS OXIDE, AND AEROSOLS IN THE ANTARCTIC STRATOSPHERE
D.J. HOFMANN, Univ. of Wyoming, School of Arts & Sciences, *Laramie, Wyoming* 82071 (DPP76-17777 A01)

Four balloon soundings to measure aerosols, condensation nuclei, nitrous oxide and fluorocarbons in the Antarctic stratosphere will be conducted at South Pole station in austral summer of 1977/78. The data obtained will be used to (1) extend the existing data base and determine if seasonal and secular trends exist in their concentrations, (2) assess the effects of volcanic activity on the stratosphere and provide information on interhemispheric transport and exchange processes in the upper atmosphere, and (3) determine the importance of condensation nuclei on clear-sky ice crystal precipitation in the Antarctic.

Logistics support is required for three scientists at South Pole and McMurdo stations during the austral summer of 1977/78.

SUPPORTED BY U.S. National Science Foundation, Div. of Polar Programs

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, MEDICALLY SIGNIFICANT PROBLEMS OF VOICE COMMUNICATION SYSTEMS
R.T. CAMP, U.S. Army, Bioacoustics Division, *Ozark, Alabama* 36362 (DA0B6887)

The acoustic environments associated with military training and operations in Army helicopters and tanks are usually hazardous and may cause interference with effective voice communications and the detection of warning signals. Most of the present aviation communication systems have characteristics that introduce both frequency and amplitude distortion of the speech signals.

This research will be directed toward the development of an improved noise-cancelling microphone for use in Army aircraft. Improved radio communication systems will be developed for Army aircraft and armor vehicles (e.g., MICV). New communication devices such as contact microphones will be evaluated for their potential use in Army systems.

ADDENDA: Supporting agency address is: MDRDC Aeromedical Research Laboratory, Ft Rucker, AL 36362

SUPPORTED BY U.S. Dept. of Defense, Army

6.0002, RESEARCH OF IMPACT AND NOISE ATTENUATING CRASHWORTHY HELMET EARCUP
J.L. HALEY, U.S. Army, Bioeng. & Life Spt. Equip. Div, *Ozark, Alabama* 36362 (DA0B6897)

To design, construct and medically evaluate the impact and noise attenuating properties of a crashworthy aviator's helmet earcup.

Twenty hand-made 'test-bed earcups' will be fabricated. The cups will be installed in helmets for in-flight evaluation by USAARL flying personnel under all flying conditions. They will be subjected to accepted standardized impact and acoustic protection evaluation techniques (ANSI Z24.22, Z90.1, etc.) to determine their effectiveness in known physical environments.

ADDENDA: Supporting agency address is: MDRDC Aeromedical Research Laboratory, Ft Rucker, AL 36362

SUPPORTED BY U.S. Dept. of Defense, Army

6.0003, ELECTRON MICROSCOPY AND RADIATION STUDIES ON LAMPBRUSH CHROMOSOMES, AND MORPHOMETRICS OF CELLULAR DAMAGE IN IRRADIATED MICE (ABBREV)
W.J. SAPP, Tuskegee Institute, Graduate School, *Tuskegee Institute, Alabama* 36088 (NCA 2-810701)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

6.0004, SIMULATOR RUNWAY TOUCHDOWN ZONE VISUAL REQUIREMENTS, TEXTURAL VISUAL CUE CONSIDERATIONS (TD-ZONE)
G.H. BUCKLAND, U.S. Air Force, Human Resources Laboratory, *Chandler, Arizona* 85224 (DF223200)

To assess effects of visual information cues upon flare and touchdown performance by experienced pilots in the ASPT under motion-no-motion conditions.

This study will employ with ASPT to display runways which differ in terms of the textural cues provided in the touchdown zone and assess the influence of these different runways on pilot performance. The influence of the different runways will also be evaluated under conditions of motion of the different runways will also be evaluated under conditions of motion (6 DOF) and no-motion in order to determine the contribution of platform motion to pilot performance. Special attention will be given to the motion feedback cue at aircraft touchdown. Ten experienced T-37 IPs will fly straight-in approaches and touchdowns under six different runway visual scenes and the two motion conditions. The runways will vary from a runway representing the minimum amount of visual information to the standard ASPT runway with a superimposed grid providing textural cues. Grids with variable spacing of lines will be superimposed on the touchdown zone to provide textural visual cues which can be readily specified. One night visual landing scene will also be used to compare day and night pilot performance in terms of the vital III technology.

ADDENDA: Supporting agency address is: AF Human Resources Laboratory FTS, Williams AFB, Arizona 85224

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0005, SKILL DEGRADATION

G.B. REID, U.S. Air Force, Human Resources Laboratory, *Chandler, Arizona* 85224 (DF223340)

To monitor the decline in performance on a high-fidelity aircraft simulator during extended periods of non-practice.

Pilots currently in non-flying jobs will be used as subjects. Subjects will be trained to a predetermined performance level on the Advanced Simulator for Pilot Training (ASPT). Rechecks will be conducted in ASPT after varying levels of non-practice to determine rate of skill degradation. The performance will be evaluated in respect to such pilot factors as amount of flying time, type of aircraft flown, and most recent aircraft currency.

ADDENDA: Supporting agency address is: AF Human Resources Laboratory FTR, Williams AFB, Arizona 85224

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0006, THERMOREGULATION IN RATS - EFFECTS OF HYPERGRAVITY AND NOREPINEPHRINE

A.B. HOROWITZ, Univ. of California, School of Agric. & Envir. Sci., *Davis, California* 95616 (NSG 2234)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

6.0007, BACTERIAL DENITRIFICATION AS A MODEL FOR MIXED ECOSYSTEM STUDIES

A. MATIN, Stanford University, School of Medicine, *Palo Alto, California* 94305 (NCA 2-745719)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

6.0008, EFFECTS OF THE HYPOKINETIC STATE ON BIOENERGETIC BALANCE USING THE RAT AS A MODEL MAMMALIAN SYSTEM

J.P. JORDAN, Colorado State University, School of Natural Sciences, *Fort Collins, Colorado* 80521 (NSG 2232)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

6.0009, RESEARCH ON LIMB FLAIL DESIGN LIMITS

A.M. STRAUSS, Univ. of Cincinnati, School of Engineering, *Cincinnati, Ohio* 45221 (DF319910; F33615-76-C-0511)

Design criteria are required to define the tolerance of the human body to the aerodynamic forces encountered during emergency escape from high-speed aircraft. Limb flail injuries represent a major cause of injuries resulting from use of ejection seats. The objective of this effort is to initiate the definition of the tolerance and failure limits of the musculoskeletal system of the human leg, specifically the knee joint, to high mechanical stress conditions such as occur in emergency egress, windblast conditions and hard or impact landings.

Components of the human knee joint, specifically the femur-anterior cruciate ligament-tibia system will be tested in translational extension at high strain rates and the results compared with rhesus monkey results previously obtained (AMRL-tr-73-117). The response and failure limits of the intact human knee to rapid rotation (tibia rotation relative to the femur) will also be determined. Special emphasis will be given to the selection, preparation, and mounting of specimens to assure optimal simulation of the live, healthy human leg.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab BB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0010, CONCEPTUAL DESIGN AND MODIFICATION OF HUMAN IMPACT RESEARCH FACILITIES

J.A. BROWN, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321460)

The success of research to define human exposure limits to emergency escape and aircraft crash environments and the development of design and evaluation criteria for personnel protective equipment in these environments is dependent upon the availability of adequate impact test facilities and equipment. The facilities must be capable of producing and measuring the complex acceleration-time histories that are experienced in USAF operations. Furthermore, they must be designed to meet the unique safety requirements associated with the use of volunteer subjects. The objective of this effort is to plan, design and/or modify impact test facilities and test fixtures required by experimental designs to meet USAF technology needs and operational safety requirements.

The capabilities of existing facilities and test equipment are assessed by test and analysis. Requirements for future research programs are studied to determine if these requirements can be met by existing equipment or by modification of this equipment. If new designs are required to meet the requirements, the design is developed through the conceptual phase and procurement specifications and plans are prepared and implemented. Operational performance capabilities and reliability of new and existing facilities are documented for review by Laboratory Engineering Safety and Human Use Committees. New instrumentation and data processing techniques are continuously investigated to improve measures of biodynamic responses and overall measurement accuracy.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab BB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0011, AERIAL GUNNERY PART-TASK TRAINER PHASE II

W.B. CAMPBELL, U.S. Air Force, Human Resources Laboratory, *Dayton, Ohio* 45433 (DF228330)

The objectives of this work unit are: (1) to develop a performance specification for procurement of a part task trainer which can provide training in the final portion of the aerial gunnery mission for tactical fighter pilots, and (2) to support Air Force Avionics Laboratory (AFAL) in administering a contract to procure an aerial gunnery part task trainer. This work will refine the technology for use of behavioral data in development of part task trainers and will result in procurement of an aerial gunnery part task trainer for Tactical Air Command. Technology gained as a result of this effort will be transitioned to organizations responsible for the design and procurement of training devices for advanced Air Force systems.

This work unit is for the second phase of a three-phase program. Phase I identified performance skills, measures, and training requirements for the final portion of the aerial gunnery mission. Conceptual designs for trainers were also developed. A prorotype trainer will be constructed by industry under contract

to AFAL during Phase II. Construction, enginineering test, and delivery to a TAC base will be1 accomplished from Jul 77 to Aug 78. AFHRL will provh1de support to AFAL during Phasd II by writing a performance specification for the trainer (Nov 76 to Jan 77). AFHRL will participate in the source selection (Apr-May 77) and will provide assistance in monitoring the contract (Jul 77-Aug 78). AFHRL, AFAL, and TAC will conduct a Phase III training effectiveness study during Sep 78-Jun 79 (approx.).

ADDENDA: Supporting agency address is: AF Human Resources Laboratory ASR, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0012, REFINEMENT AND MODIFICATION OF VISUAL SYSTEM MODEL

M.W. CANNON, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321540)

In order that the Aforce can properly assess the utility of various electrooptical display and image analysis systems, in use or contemplated, man-oriented system metrics must be developed. The objective of this work unit is to refine and modify the AMRL/BBM visual system model so that it will be able to make human performance predictions for a wider variety of inputs than is now possible. In particular, the upgrading of the model will be aimed toward developing a flexible evaluation tool for electrooptical systems by predicting human performance at tasks involving time-varying imagery with a wide dynamic range of light intensity.

The present static form recognition capability will be continually refined and upgraded to improve agreement between the model and experimental data. The model will be modified to include spatial frequency masking effects, flicker phenomenon and brightness computations. Model responses will be continually checked against experimental results from the literature, in-house and contractual efforts. Human performance criteria for certain visual recognltion tasks will be derived from the model at appropriate points in its development.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab BB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0013, COGNITIVE ASPECTS OF VISUAL PERFORMANCE

F.E. GOMER, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF320900)

The fundamental goal of this program is to specify the manner in which task requirements affect the observer's ability to acquire and process visual information. Research findings will be used to aid design engineers in configuring display systems so that they effectively complement the specific cognitive functions of the operator. Products of this work unit support AFSC development goals TC-1, TC-7, C3-3, and MS-4.

Data will be provided concerning recognition and identification functions for symbolic plus imagery displays. Performance measures will be derived from conventional psychophysical, signal detection, and transient VER techniques. Efforts will be toward: (a) determination of the extent to which late components of the ensemble averaged visual evoked response (VER) reflect the observer's interpretation of displayed information, (b) real-time detection and classification of VERs related to information processing, (c) analysis of eye movement behavior underlying visual perception, and (d) understanding of how physical stressors degrade extraction and processing of visual inputs. Several experiments will attempt to successfully detect single event VERs through digital filtering of scalp recorded brain activity. Computer pattern recognition procedures will be implemented to partition the individual filtered responses into categories on the basis of differences either in the physical properties of the eliciting stimuli or in the outcomes of decision-making operations. A contract (WU 71841112) (Purdue University) supports this effort. The SRI eye-tracker will be used to determine how particular task requirements affect patterns of visual search. It will also be employed to trigger VERs following eye fixations. Out-year work units: the limits of effective visual information processing under vibration and acceleration will be determined. Performance to be monitored includes visual search, motor responding, and psychophysiological activity. This program will be coordinated with BBI. Equipment and personnel associated with the display lab, the image metric lab, and the visual response lab will contribute to all research endeavors. Results will be of value to WUs in RTEs A1, A4, B3, B4, and C5, as well as to other WUs in RTEA3.

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0014, EFFECTS OF ACCELERATION-INDUCED CARDIOPULMONARY FUNCTION ON HUMAN OPERATOR PERFORMANCE

W. INGE, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF322430)

To measure the effect of GZ acceleration on cardiopulmonary function and the impact of this stress-response interaction on human operator performance. The need exists to describe and optimize physiologically drive performance parameters for Air Force operations. This technology will define those physiological criteria which contribute to the optimization of human performance.

The effects of acceleration on cardiac output, regional blood flow and rheological changes will be delineated in the instrumental animal. relevant findings in these areas of research will direct subsequent studies involving performance trained nonhuman subjects. Pulmonary function tests (i.e., lung closing volumes) accomplished on human subjects may offer a data base which can be correlated with, and predictive of, human operator performance decrements under the stress of high g environments. These performance decrements will be determined either by using air combat simulation on the AMRL Dynamic Environmental Simulator or by conventional performance measurement techniques.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab EM, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0015, PERFORMANCE MODEL OF SUSTAINED G EFFECTS ON AIR COMBAT EFFECTIVENESS

W.H. INGE, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF322550)

Primary objectives are: (a) to obtain data on human operator performance during and following exposure to sustained high g stress, (b) to measure associated physiological parameters, and (c) to formulate a model of human operator performance under sustained acceleration. These objectives are part of an ongoing USAF effort to examine air-to-air combat tracking scenarios and mathematically describe the pilot in order to improve fighter tactics and aircraft design (TAC Avenger).

Human subjects will be exposed to standard sustained high g profiles on the AMRL Dynamic Environment Simulator and tracking errors recorded for use in model development; performance and stress-related physiological measures will also be made to determine mechanisms underlying performance decrements observed during acceleration stress.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab EM, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0016, IMAGE DISPLAY METRICIZATION

W.L. MARTIN, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF320970)

The objective of this work unit is to develop, refine and validate display measures and techniques which are relatable to observer performance. This includes cathode ray tube (CRT) displays, liquid crystal displays and light-emitting diode displays used for imagery or symbology purposes.

The image metric laboratory will be utilized to investigate various display measuring procedures. Initial effort will center on CRT displays utilizing imagery producing sources. Later efforts will extend these mensuration techniques to symbology displays and solid-state display devices, i.e., light emitting diode arrays, liquid crystal matrix displays, etc. The overall capability of the image metrics laboratory will be developed to allow a systematic

trade-off of candidate photometric/radiometric mensuration techniques based upon reliability, repeatability and appropriateness of each measure for describing display image quality. Candidate measurement techniques will then be evaluated utilizing psychophysical and electro-physiological studies to ascertain the value of the approach for correlating with operator performance. A specific ongoing effort will continue to evolve a unity image quality metric based upon description of the interaction of human visual modulation threshold function and the measured modulation transfer function capabilities of the display device. A product of this work unit therefore will consist of validated standardized techniques for assessing imaging display performance which can be used to establish a Mil Std for imaging displays. In addition, the output of this effort is essential for establishing the overall unitary/image quality metric described in RTE-B5 work unit B - Display/Operator Interface and Target Acquisition Prediction Model in RTE-D1 work unit b. This work unit supports AFSC development goals TC-1, TC-7, C3-3 and MS-4. This work unit replaces work unit 71841101, image/display quantification.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab HE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0017, TECHNOLOGY APPLICATION TO OPERATIONAL NOISE PROBLEMS

C.W. NIXON, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321390)

Air Force regulation 161-35 on hazardous noise exposure, which sets forth the AF noise abatement program, assigns responsibility to the biological acoustics branch to provide consultation and technical assistance on personnel safety and effectiveness problems that are beyond the capabilities of the base. The objective is to provide consultation and apply the current technology base to the wide range of acoustic problems found in AF activities.

The approach is to conduct laboratory and/or field evaluations of specific problems or items of equipment to define the threat potential to health and performance capability and propose satisfactory solutions that comply with AF policies. Individual efforts are usually short term and include technical questions relating to sonic boom, noise exposure limits, ultrasound, infrasound, impulsive noise, communication equipment and hearing protection. Specific efforts include problems such as flight helmet effectiveness, communication with a fire fighter's helmet and with a new oxygen mask microphone in noise. Requests originate from all levels of AF and other governmental agencies and specifically include base flight surgeons, bio-environmental engineers, systems development offices and the life support SPO.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch. Lab. BB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0018, CONTROL-DISPLAY INTEGRATION AND EVALUATION

J.L. PORTERFIELD, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321060)

The purpose of this work unit will be to develop new control, display, and feedback hardware and software concepts that utilize hand, head, eye, and other human response modes as controllers to improve the piloting, weapon delivery, and reconnaissance sensor control of manned and unmanned aircraft. This work unit supports AFSC Development Goal TC-2.

The basic approach will be to collect man-machine system performance data on laboratory simulation, breadboard, and/or prototype equipment designed to make efficient use of the human's natural perceptual and response capabilities. The final product will be new equipment concepts and designs that have been developed from and validated by man-machine system performance data. The following control-display hardware concept work is planned: (1) eye- and head-controlled switching, (2) tracking situation display, (3) multi-resolution eye-aimed television, (4) helmet-mounted oculometer, (5) voice controller, (6) eye-controlled sensor zoom, and (7) target trajectory and operator response predictor displays. In addition, pilot studies will be conducted on new concepts for the display of control information, the use of non-utilized human response modes to control equipment, and techniques to modify the human's response signals to obtain more optimum control. A basic tool to be utilized in this work will be the use of digital computers as follows: (1) to process the environmentally sensed information before it reaches the display, (2) to filter and modify the human's response signals before they reach the controlled element, and (3) to process and modify feedback information about the controlled element before it is returned to the display. This effort was previously reported under work unit 7184-04-43, control concept development.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab HE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0019, VALIDATED DENITROGENATION PROCEDURES FOR HIGH-ALTITUDE OPERATIONS

J.D. ADAMS, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322300)

This effort will develop more effective procedures for the prevention of decompression sickness during exposure to potential decompression hazards. A significant number of cases of decompression sickness occur each year in USAF and other aerospace operations. This suggests current procedures for its prevention are not optimally effective. In addition, unusual conditions have arisen where established denitrogenation schedules do not exist or are ineffective, such as flying after driving, minimum frequency of high altitude exposure, the impact of interruption in denitrogenation, differences between male and female denitrogenation rates and prebreathing with less than 100 percent oxygen for on-board oxygen generating systems. Past efforts of defining decompression hazards and establishing preventative measures have used empirical and subjective testing of humans in altitude simulators with symptoms of decompression sickness being an endpoint. Recent advances in technology have provided the ability to use non-invasive methods to develop required preventative criteria. These new methods are not only more precise but involve less risk to human subjects and are lower in cost. This effort will be directed towards the development and use of these objective techniques to develop more optimal preventative measures in a wide variety of current aerospace decompression problems.

The value of non-invasive techniques to monitor the condition of human volunteers both during the prebreathing and the actual exposure phases of simulated high-altitude missions will be tested. During the prebreathing phase, nitrogen washout will be monitored, and during the altitude exposure phase bubble formation will be studied. Human subjects will be tested by a non-invasive technique for monitoring and evaluating the state of denitrogenation under various aerospace operational profiles. Denitrogenation curves will be used to evaluate and establish oxygen prebreathing criteria for various missions including those employing 100 percent oxygen or gas mixtures from on-board oxygen generating system. Specific efforts will include: establishment of minimum safe excusal period between repeated high altitude exposures, determine whether 15 min or 30 min denitrogenation schedule should be used before physiologic training flights, and evaluation of the effects of airbreathing interruption in denitrogenation. (Text Abridged).

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0020, IMPACT OF GROUND-TIME FACTORS ON CREW RATIO/WAR PLAN COMMITMENTS

H.M. HUGHES, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322150)

As a part of the Joint Chiefs of Staff contingency plans, the military airlift command is tasked to maintain a capability that depends on the number of C-5 and C-141 trained crews available, expressed as an authorized crew ratio. In a USAFSAM analysis supporting the FY 75 authorization, the distributions of mac operational ground times for the C-5 and C-141 were identified as being critical to the achievement of JCS tasking. The objective of this effort is to determine the effect of various ground-time distributions upon the crew ratio required to meet JCS tasking. The result will be a report containing formulas and/or tables displaying such relationships.

A computer simulation program, developed at USAFSAM, which focusses on the aircrew aspects of airlift operations, will be used to simulate C-5 and C-141 operations under contingency conditions. Ground time distributions will be varied from run to run, noting the effect on crew ration required to achieve the specified workload. General principles will be sought for use in future simulations and for evaluation of postulated ground time achievements.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine BR, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0021, SORBENT SAMPLING SYSTEMS FOR N-NITROSODIMETHYLAMINE

W.W. LACKEY, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF320220)

This work unit will develop, test and evaluate sorbent sampling systems for detection and quantitative measurement of N-nitrosodimethylamine (NDMA) in ambient air. NDMA is an intermediate compound in the industrial synthesis of unsymmetrical dimethyl hydrazine (UDMH) rocket fuel, and is one of the suspected carcinogenic compounds controlled by OSHA. The development of a sorbent sampling tube for direct off-gas analysis by GC-MS is a cost-effective field replacement for cold trapping methods currently in use. This effort supports the AFLC (SAALC) directorate of energy management program for Air Force procurement of UDMH rocket fuel.

Several types of chromatographic packing materials will be evaluated for sorption efficiency and recovery using standard, NDMA gas mixtures at low concentrations. Breakthrough volumes will be determined for each material as a function of sample flow rate, temperature, and relative humidity. Comparative analyses will be conducted to standardize each material against a referee method involving cryogenic trapping, with GC-MS, and thermal energy analysis.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine VN, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0022, UPPER GASTROINTESTINAL HEMORRHAGE IN USAF FLYING PERSONNEL

W. MORTON, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF321870)

To establish better selection and retention criteria by determining incidence of UGI hemorrhage as a complication of peptic ulcer disease in USAF flying personnel, identifying risk factors that may predispose one to recurrent peptic ulcer disease or its complications, and determining the incidence of recurrent hemorrhage in patients who initially bled from a cause other than peptic ulcer disease.

Establish a protocol for evaluation by USAF Regional Medical Center personnel or consultants of all aircrew members who suffer acute gastrointestinal hemorrhage. Following initial stablization and treatment, the patient would be evaluated at USAFSAM. If, after evaluation, none of the specific disqualifying defects defined in the protocol existed, a waiver would be granted. All waivered patients would be followed on a regular basis at USAFSAM for a minimum of five years to achieve the objectives outlined.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine NG, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0023, EVALUATION OF CD EQUIPMENT DURING EXPOSURE TO HIGH G AND EXTREME CHANGES IN THE COCKPIT ENVIRONMENT

R.D. SINCLAIR, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322610)

Previous efforts in this area were documented under work unit 7930-09-15. The purpose of this effort is to conduct in-house test and evaluation of chemical defense personal equipment in direct support to the 412A Life Support SPO, Chemical Defense Division (AEL). The work unit is structured to address biomedical and environmental test requirements that are expected to arise during various stages of new equipment development and modification of existing equipment by the SPO. The capability to conduct quantitative leakage assessment of CD respiratory devices will be established and the chemical properties of CD filter materials will be studied for their compatibility with the flight environment. The justification for establishing this supportive effort is based upon an approved Memorandum of Agreement between AMD and ASD/AEL (30 Jun 76), and TAF (ROC) 326-75, 7 Nov 75 (CW Mask for Tactical Fighter Aircrew). The MOA states that T&E support will be provided on a cost reimbursement basis, the latter defined as a specific cost schedule in AMD letter to ASD/AEL, 9 Feb 76.

The work unit monitor will serve as the OPR for the CD program to be accomplished within the USAFSAM. He will plan programs and coordinate all t e activities to be accomplished by various organizations within the Laboratory. However, laboratory elements at both the USAFSAM and AMRL will charge against this work unit to insure proper reimbursement. specific areas of test and environmental simulation will consist of altitude exposure, including pressure breathing levels and rapid decompression, respiratory impedance measurements, thermal/cold effects, air combat manuevering (ACM) g exposures, mask leakage characteristics, equipment related performance decrement, and integration with other life support equipment and cockpit configurations. Realistic operational profiles for the environmental conditions will be simulated and the sodium chloride cloud technique will be utilized for lead testing purposes (actual CW agents, simulants or antidotes will not be used for any tests). The OPR and others will also provide biomedical consultation and review technical requirements for equipment design when requested.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine VN, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense, Air Force

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, DATA SYSTEMS STUDY FOR RETRIEVING REMOTE-SENSING STRATOSPHERIC POLLUTION MONITORING DATA FROM SATELLITE, AIRBORNE, AND SURFACE PLATFORMS

R.D. WILKINS, Georgia Inst. of Technology, Graduate School, *Atlanta, Georgia* 30332 (NAS 1-14947)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

7.0002, NONPARAMETRIC STATISTICS, TOPICS WHICH HAVE APPLICATIONS TO COMMUNICATION THEORY, METEOROLOGY AND CIRCULAR DATA ANALYSIS

M.L. PURI, Indiana University, School of Arts & Sciences, *Bloomington, Indiana* 47401 (DF042230; AF-AFOSR-2927-76)

This proposed research is for a continuation of the research currently being conducted under Air Force grant AFOSR 71-2009. The Air Force encourages research in the following areas: (1) The development of signal detection techniques useful when the communication systems are operating in an environment where there is jamming or any other reason for uncertainty that renders the underlying signal and noise distributions unknown. (2) Meteorological forecasting of airfield ceiling conditions for aircraft routing. (3) Improving the analysis of circular data which is used in solving navigational problems and analyzing wind directions. (4) Improve the analysis of errors in missile targeting and target localization and map making using spherical distributions. This research program is aimed at fulfilling the above objectives by proposing to study various problems connected with the theory of rank order statistics, discriminant analysis, the order

statistics from non-normal populations, the multiple decision procedures, and nonparametric procedure for stochastic processes. These procedures have applications in communication theory, signal detection problems, meteorology and forecasting airfield ceiling conditions, etc. It is also proposed to study some parametric, as well as nonparametric, problems connected with the analysis of circular data which find practical applications in many natural sciences. It is also proposed to study certain problems in multivariate analysis based on spherical distributions. It is also proposed to study some limit theorems and the law of the iterated logarithm for double sequences and their applications. Finally, it is proposed to continue writing the second volume of an advanced monograph on nonparametric techniques in multivariate analysis.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NM, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

7.0003, FINITE-ELEMENT ANALYSIS OF TRANSONIC FLOWS 14371-M

G.J. FIX, Carnegie Mellon University, Mellon Institute of Science, *Pittsburgh, Pennsylvania* 15213 (DA0E9249; DAAG29 77 G0026)

To investigate the numerical solution of the partial differential equations describing transonic flow. Relevance - the subject matter has clear relevance to many Army flight problems including flows around rotors, missiles and artillery projectiles.

A new variational principle will be implemented which has certain desirable properties when used in conjunction with the finite element method. This variational principle will be investigated first in the two-dimensional case and then later in the three-dimensional case.

ADDENDA: Supporting agency address is: DARCOM Army Research Office, Box 12211, Research Triangle Park, NC 27709

SUPPORTED BY U.S. Dept. of Defense, Army

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, PLASMA COMPUTATIONAL PHYSICS

C.K. BIRDSALL, Univ. of California, Electronics Research Lab., *Berkeley, California* 94720 (EY-76-S-03-0034,P.A.128)

Plasma Physics is being done by many-particle computer simulation. Thousands of electrons and ions are followed in space and time in their own and applied electric and magnetic fields. Detailed information is obtained about the linear and nonlinear behavior of plasma oscillations, waves, instabilities, heating and diffusion. The results are applied primarily to plasmas suitable for fusion power machines. The simulation effort is complemented by theory and analysis and other computation such as solution of dispersion relations; in addition, simulation methods are being analyzed and improved.

Present projects include: 1. cross-field diffusion of electrons in presence of a (drift) wave; 2. ring-plasma instability, in a two-ion (D beam incident on T target); 3. quasilinear transport in a mirror machine (including radial dependence); 4. development of hybrid (particles plus fluids) simulation methods; 5. plasma simulation handbook: 6. completion of prototype mini-users' center, connected to the MFE National Computer Center at LLL.

RESULTS: Results have been reported regularly at APS Division of Plasma Physics meetings, Sherwood Theory Meetings, Gordon Conferences, as well as published in the Physics of Fluids, Nuclear Fusion, and Journal of Computational Physics, as well as in Quarterly Progress Reports.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Magnetic Fusion Energy

8.0002, NEUTRON SCATTERING AND REACTIONS

F.P. BRADY, Univ. of California, School of Letters & Science, *Los Angeles, California* 90024 (PHY77-05301)

This grant will continue work supported under NSF grant PHY71-03400A06 at the University of California Crocker Nuclear Laboratory. Studies of neutron interactions with protons, deuterons and heavier nuclei comprise a major portion of the research program. Polarized and unpolarized beams of almost monoenergetic neutrons are generated with deuterons accelerated by the laboratory cyclotron.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0003, STUDIES IN PARTICLE PHYSICS

R.P. HADDOCK, Univ. of California, School of Letters & Science, *Los Angeles, California* 90024 (EY-76-C-03-0010 0025)

The objective of the program is research in particle physics. Experiments are conceived, staged, and analyzed at UCLA and carried out with accelerators at National Laboratories. The proposed research projects concern investigations in elementary particle physics at medium energy. Subjects being studied include (a) Pion-nucleon and nucleon-nucleon interactions; (b) invariance principles and selection rules; (c) electromagnetic and weak interactions of hadrons. Specifically, we propose to investigate the following processes: 1) pi plus T yields gamma 3He and pi minus 3He yields gamma T to study time-reversal invariance by the comparison with the differential cross section of the inverse reactions; 2) positive pion T yields neutral pion 3He, pi minus 3He yields neutral pion T, pi plus or minus T yields pi plus or minus T and pi plus or minus 3He to study charge symmetry and isospin invariance by comparing the differential cross sections using the triangle inequalities; furthermore, to test specific calculations of pion interactions involving isobaric analog transitions on bound nucleons; 3) pi plus or minus p yields pi plus or minus p gamma, to test the validity of the soft photon approximation (SPA), external emission dominance (EED), and to investigate specific proposals to determine the magnetic dipole moment of the delta (1232) resonance; 4) pp yields pp gamma, to test recent ideas on hadron-hadron bremsstrahlung at incident energies substantially above the threshold for pion photo production, specifically, the validity of SPA and EED; furthermore, to study (pp) off-mass shell amplitudes. 5) small angle pp elastic scattering to study the t-dependence of the nucleon scattering amplitude.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Physical Research

8.0004, FUNDAMENTAL STUDIES OF ALGAAS-GAAS HETEROJUNCTIONS FOR SOLAR ENERGY CONVERTERS

G.L. PEARSON, Stanford University, Stanford Electronics Labs., *Palo Alto, California* 94305 (DMR76-84373)

This research is a continuation of fundamental studies on aluminum gallium arsenide (AlGaAs)-gallium arsenide (GaAs) semiconductor heterojunction structures. The investigation will provide results which will assist in the construction of efficient grown junction AlGaAs-GaAs solar cells as well as understanding and design of Au-AlGaAs-GaAs Schottky barrier solar cells. The following areas will be studied: (1) Collection mechanisms of electron-hole pairs generated in the GaAs layer; (2) Preparation and evaluation of Au-AlGaAs-GaAs Schottky barrier cells having different stoichiometries; (3) The effects of oxide layers on heterojunction Schottky barrier diode performance; and (4) Optical characteristics of Au-AlGaAs-GaAs Schottky barrier cells.

These studies continue research begun under NSF Grant DMR72-03141.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0005, ELECTRON TUNNELING STUDIES OF SOLID SURFACES AND INTERFACES

P.K. HANSMA, Univ. of California, School of Letters & Science, *Santa Barbara, California* 93106 (DMR76-83423)

Inelastic electron tunneling studies of adsorbed atoms and molecules on surfaces of metals and insulators previously supported by NSF grant DMR-7203276A02 will be continued. Specifically, inelastic electron tunneling spectroscopy will be used: (1) to identify new species, and possibly catalytic inter-

mediates, on both oxides and supported metals, (2) to further develop the use of peak intensities of determining the orientation of surface species, (3) to extend research on electron beam damage in monolayers, (4) to explore reactions between monolayers and evaporated metals, atoms, and finally (5) to continue two fruitful collaborations in elastic and Josephson tunneling.

Experimental investigations of the bonding between carbon monoxide and metals supported on alumina will be continued. The long-term goal in this area is to find new and useful information about an important class of reactions: the synthesis of hydrocarbons from the products of coal gasification on supported metal catalysts.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0006, ROCKET RESEARCH IN SOLAR ULTRAVIOLET SPECTROSCOPY
G.T. ROTTMAN, Univ. of Colorado, Graduate School, *Boulder, Colorado* 80302 (NSG 5178)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

8.0007, SPECTROSCOPY OF ELECTRONS IN INVERTED METAL OXIDE SEMICONDUCTOR STRUCTURES
R.G. WHEELER, Yale University, Graduate School, *New Haven, Connecticut* 06520 (DMR75-14026 A01)

The quasi-two-dimensional electronic sub-bands in a semiconductor surface inversion layer will be investigated by means of spectroscopic and transport experiments. Silicon MOSFET (metal oxide semiconductor field effect transistor) structures will be fabricated by thermal oxide growth on 100 and 110 single-crystal silicon surfaces. The transport and recombination kinetics of the carriers in the inversion layer will be studied by measurement of the optical absorption, photoconductivity and conductivity. The potential use of this device structure for tunable infrared and sub-millimeter wave detectors also will be investigated.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0008, EXPERIMENTAL LABORATORY STUDIES OF SHORT-LIVED AND LONG-LIVED NEGATIVE IONS OF ATOMS AND MOLECULES
S. WONG, Yale University, School of Engineering, *New Haven, Connecticut* 06520 (PHY76-00235 A02)

Experiments will continue studying the interaction of low-energy monoenergetic electrons with simple molecules, to understand the role of short-lived and long-lived negative ions in scattering processes. The molecules studied will include benzene and deuterium. In addition, collisions between rare gas atoms in high Rydberg states and simple molecules will be studied, as will the inelastic scattering processes on surfaces by electron impact.

This work represents a continuation of that currently supported by Foundation Grant PHY76-0235AO1.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0009, HIGH-ENERGY PARTICLE PHYSICS
J.E. LANNUTTI, State University of Fla. Sys., School of Science & Technology, *Tallahassee, Florida* 32307 (EY-76-S-05-3509)

The research proposed herein, consisting of both theoretical & experimental efforts, is a study of several of the fundamental forces of nature.

The experimental program will entail work primarily in two areas: (1) continuing measurement and analysis of two Fermilab 15-ft. bubble chamber experiments (negative pion p at 250 MeV/c & negative pion p at 360 MeV/c); and (2) construction, testing & running a triple bond search experiment on the BNL MPS.

The theoretical program will consist of a continuing study of the dynamics of high-energy scattering processes & gravitational theories. The group's efforts will include work on the development of theoretical models, phenomenology, & analysis of data. In addition, we will continue investigations of the fundamental theories for long-range forces - gravitational and electromagnetic.

RESULTS: Experimental: Search for Charmed Mesons & Baryons has revealed one candidate; Study of KsKs System showed S bond at high t; 15GeV/c positive pion n yields positive pion negative pion p analyzed using LPS separates out various exchange mechanisms; Study of neutral strange particle production mechanisms at 250 GeV/c reported; Inclusive gamma production at 250GeV/c being measured.

THEORETICAL: Workshop on G variation held & conference proceedings to be published; paper on gravitational analog of magnetic monopole submitted; role of A1 exchange in negative pion p yields positive pion negative pion n has been analyzed; Spin dependence of inclusive reactions has been analyzed; Three-body isobar model has been applied to K minus n yields lambda negative pion neutral pion; Model bounds on slopes for inelastic diffractive processes have been analyzed.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Physical Research

8.0010, LOW-ENERGY EXPERIMENT TO MEASURE A WEAK COUPLING OF THE NEUTRINO CURRENT
T.P. LANG, Georgia Inst. of Technology, Graduate School, *Atlanta, Georgia* 30332 (PHY77-03680)

The proposed project is a continuation of an experiment on neutrino interactions. The goal is to obtain information on the nu e plus d yields n plus p plus nu e. During the funding period one of the units required for detection of the reaction will be completed and tested. The unit, which contains the target material for the reaction, should provide a unique signature of the neutral reaction.

This research is a continuation of that currently supported by Foundation grant PHY75-21295 A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0011, SUPERCONDUCTING MICROTRON AND NUCLEAR STRUCTURE RESEARCH
P. AXEL, Univ. of Illinois, School of Liberal Arts & Sci., *Urbana, Illinois* 61801 (PHY77-08100)

This grant supports the design and construction of a unique high-duty-cycle electron accelerator. The accelerator will consist of a superconducting linear accelerator section accelerating electrons which will be bent in magnetic fields to recirculate through the accelerator section. The present aim is for electrons of about 60 MeV. This accelerator could serve as a prototype for a higher energy electron microtron. Preliminary studies of a high-energy accelerator will be carried out.

Nuclear reactions induced by electrons and photons (produced in electron bremsstrahlung) of precisely defined energies will be used to study nuclear structure, particularly the nuclear collective motion. High quality coincidence experiments will result from the high-duty-cycle characteristics of the accelerator.

This work is a continuation of that currently supported by Foundation grant no. PHY71-02785 A08.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0012, LIGHT-SCATTERING STUDIES OF PHONON INTERACTIONS IN PIEZOELECTRIC SEMICONDUCTORS
R. BRAY, Purdue University, School of Science, *Lafayette, Indiana* 47907 (DMR76-82090)

The following research projects will be carried out: (1) Brillouin scattering of reflected light experiments, in order to determine the mechanism of reflected light scattering for bulk phonons. (2) X-ray scattering studies of amplified phonon beams and laser-generated phonons. (3) Studies of the effects of intense

laser radiation on the Raman spectrum in order to check the current concepts relating to the electron-optical phonon interaction. (4) Modulation of the Raman spectrum by acoustoelectric domains, in order to study the effect of piezoelectric fields on the optical phonon lines.

Reference: DMR74-17606 A01.

This is the first year of a 2-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0013, NEUTRON CROSS SECTIONS AND NUCLEAR STRUCTURE

M.T. MCELLISTREM, Univ. of Kentucky, School of Arts & Sciences, *Lexington, Kentucky* 40506 (PHY77-08725)

This work consists of a broad program of research in the area of neutron physics. Systematic studies of the elastic and inelastic scattering of neutrons will be made on a variety of targets. (p,n) reactions will also be studied on a number of targets. All these data will be used in an attempt to develop adequate models to describe the interactions of neutrons with nuclei; optical model parameters will be deduced, including isospin-dependent terms. In addition, considerable effort will be devoted to the development of high accuracy neutron flux measurement techniques. All of this work bears directly on neutron interactions with matter, which is directly related to the energy needs of the country.

This work is a continuation of that currently supported by Foundation grant PHY73-04851 AO3.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0014, ELECTRON EXCITATION CROSS SECTIONS FOR MULTIPLY CHARGED IONS

J. CALLAWAY, Louisiana State Univ. Systems, School of Arts & Sciences, *Baton Rouge, Louisiana* 70803 (EY-76-S-05-4881)

The work proposed is the continuation of theoretical calculations of the cross sections for excitation of positive ions of the lithium and helium isoelectronic sequences by electron impact. The energy range considered is from the threshold for excitation to (roughly) 4 times the ionization energy. The calculations will be based on a close coupling expansion with exchange and including pseudostates. Different methods of solution of the coupled integro-differential equations including the R matrix method, the matrix variational method, and the non-iterative integral equation method will be investigated for accuracy and speed. The energy range studied is one in which simple approximations of the Coulomb Born or distorted wave type are not valid. The contribution of Rydberg series of resonances below the excitation thresholds will be determined. In the coming year, principal attention will be devoted to the ions C3 ion and C4 ion, which can serve as test cases for the theoretical methods under development. Methods for extrapolation along isoelectronic sequences will be investigated in order to study excitation cross sections for highly stripped impurity ions in high temperature plasmas of interest in thermonuclear reactors. Consideration will be given to the inclusion of relativistic effects in both the structure of the ion and in the description of scattering as the nuclear charge increases.

RESULTS: Cross sections for the electron impact excitation of C3 ion and Ar15 ion have been obtained using a 5-state close coupling expansion and the non-iterative integral equation method of Smith and Henry. Electron energies up to three times the threshold energy have been considered. Results of other authors neglecting coupling and/or exchange have been shown to be inaccurate by more than 10%. A pseudostate calculation for He in which 1s, 2s, 2p, 3s and 3p functions are included in a close coupling expansion, gives results for 1s yields 2s excitation which agree with experiments above 70 eV.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Physical Research

8.0015, DYNAMICAL SCALING OF PHASE TRANSITIONS

J.P. RICHARD, Univ. of Maryland, School of Arts & Sciences, *College Park, Maryland* 20742 (DMR74-14372 A01)

Research in theoretical statistical mechanics will be carried out, through generalization of dispersion theory of the critical correlation function. This work will be applied to the critical dynamics of the binary liquid and the Heisenberg ferromagnet.

This is a renewal of research previously supported under DMR74-14372.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0016, FOUNDATIONS OF RELATIVISTIC QUANTUM THEORY, INTERACTIONS OF HADRONS, AND ELECTROMAGNETIC INTERACTIONS OF ELEMENTARY SYSTEMS

J. SUCHER, Univ. of Maryland, School of Arts & Sciences, *College Park, Maryland* 20742 (PHY74-02211 A03)

Research on problems in the domain of quantum field theory and the interactions of elementary particles initiated under NSF grant MPS74-02211 AO1 will be continued. Specific topics planned for investigation include: (1) quantum electrodynamics of rare decays of the new particles, (2) CP violation and time evolution of the neutral kaon-neutral kaon system, (3) almost point-like behavior of off-shell particles in field theory, (4) universal gauge theories, (5) renormalizability constraints for massive vector-meson field theories, (6) renormalization and new symmetries in non-abelian gauge theories, (7) electromagnetic polarizabilities in relativistic quantum theory, (8) stability analysis of nonlinear field equations, soliton solutions and their quantization.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0017, RESONANCE AND RADIATION PHYSICS

R.V. POUND, Harvard University, School of Engineering, *Cambridge, Massachusetts* 02138 (DMR76-84497)

Research will be carried out on resonance phenomena such as Mossbauer effect and NMR applied to particular examples. The two Mossbauer resonance examples, 67Zn and 181Ta, are chosen as the most promising for improving available resolution of small energy shifts. Exploration of line width, depth and isomer shifts of 67Zn in metals and semiconductors is planned as a supplement to past success with zinc chalcogenides. Efforts to improve the resolution available from 181Ta are planned.

Another project is the further development of X-ray light pipes. Use of synchrotron radiation of SSRP as a medium to explore nuclear resonance fluorescence, particularly if 181Ta depends upon the development of a detector with rapid recovery from overload. Finally, continued studies of NMR at low temperature of (approximately 0.05 degrees K) and high fields particularly, will be carried out with further work on the ortho-para conversion in H2 and on the NMR of H2 and D2 at lower frequencies.

This is the first year of a 2-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0018, PHYSICS OF FRACTURE IN ORIENTED POLYMERS 13630-MS

D.K. ROYLANCE, Mass. Inst. of Technology, Graduate School, *Cambridge, Massachusetts* 02139 (DA0E9128; DAAG29 76 C 0044)

To study fracture phenomena in oriented semi-crystalline polymers and develop an analytical rate-process model of fracture which depicts realistically the distribution of spatial defect sites as well as the distribution of tie-chain lengths. The research is relevant to Army high-performance applications of structural polymers in materiel such as armor, canopies, and fuse components.

Gel permeation chromatography (GPC) will be used to determine the distribution of intercrystalline tie-chain scission that occurs in oriented polymers subjected to stresses up to and including fracture, and at various temperatures and loading rates. The GPC observations will be correlated with a thorough characterization of the material structure (especially amorphous frac-

tion and orientation) and with auxiliary measures of molecular fracture (EPR, IR spectroscopy, and small-angle x-ray diffraction).

ADDENDA: Supporting agency address is: DARCOM Army Research Office, Box 12211, Research Triangle Park, NC 27709

SUPPORTED BY U.S. Dept. of Defense, Army

8.0019, VISIBLE LASER DISCHARGE STUDIES II
J.A. MANGANO, Avco Corporation, *Everett, Massachusetts* 02149 (EY-76-C-02-2922)

The first objective of this study is to develop a computer code to solve the Boltzmann electron transport equation in gas mixtures and for pumping conditions characteristic of visible lasers. The code will include the effects of elastic collisions, excitation of ground and excited states, superelastic collisions, attachment, ionization and electron-electron and electron-ion collisions.

The second objective of this study is to determine the general applicability of the two-stream instability and plasma return current discharge for pumping lasers. In order to assess the merits of these systems it is necessary to know the rate for conversion of beam energy to plasma thermal energy (i.e., the effective stopping power of the medium), the limiting efficiency for this conversion, the resulting plasma electron density and temperature, and if possible the plasma electron distribution function as a function of electron beam energy and current density and the pressure and composition of the medium.

The study should employ analytic and numerical models to predict system performance together with an experimental program to guide and confirm the modeling results.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Laser Fusion

8.0020, POSITRONIUM EXPERIMENTS
S. BERKO, Brandeis University, School of Arts & Sciences, *Waltham, Massachusetts* 02154 (PHY76-23883)

Positronium (Ps), the electron-positron bound state, has long been recognized as the ideal 'atom' to be investigated as a test of the quantum electron-dynamical theory of atomic systems. Over the past 25 years this promise has been in the process of being realized through ever-increasing precision investigations of the ground state (n equals 1) of Ps. However, it has been only until very recently that the elusive first excited state (n equals 2) could be produced and a preliminary investigation of its fine structure carried out, thus laying the groundwork for precise testing of the 'Lamb shift' self-energy effects normally not accessible in the n equals 1 experiments. This recent discovery is based on n equals 1 and n equals 2 Ps emission from solid surfaces that are bombarded with a beam of low-energy positrons. Research will continue to improve on the preliminary n equals 2 measurements through improved microwave techniques and an investigation of the Ps emission. In addition to improving the direct emission of n equals 2 Ps, the investigations will also be aimed at using the extremely efficient n equals 1 Ps emission phenomenon for valuable information relevant to the n equals 2 work as well as other important areas of Ps research such as n-1 Ps-atom collisions, Ps interactions with external electromagnetic fields, and n equals 1 Ps lifetime measurements.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0021, EXPERIMENTAL NUCLEAR PHYSICS
J.W. JANECKE, Univ. of Michigan, School of Lit. Sci. & the Arts, *Ann Arbor, Michigan* 48104 (PHY76-00287)

Experiments will be conducted at the Indiana University Cyclotron Facility, at the Lawrence Berkeley Laboratory 88-inch cyclotron and at the Princeton University cyclotron to study nuclear reactions which give information on multiparticle correlations or cluster structures within nuclei. The (d,6Li) reaction will be studied at 55 MeV at the 88-inch cyclotron using the magnetic spectrometer. The inverse (6Li,d) reaction will be studied at IUCF when the 6Li beam becomes available. These reactions study the alpha-particle cluster structure of nuclei. At Princeton University more complicated nuclear reactions such as the (alpha, C12 reaction) will be studied using the high-resolution, large solid angle QDDD spectrometer; these studies will also provide information about very neutron-rich nuclei such as S39, S40, S41.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0022, A SEARCH FOR NEUTRAL CURRENT INTERACTIONS IN ATOMIC HYDROGEN AND DEUTERIUM
R.R. LEWIS, Univ. of Michigan, School of Lit. Sci. & the Arts, *Ann Arbor, Michigan* 48104 (PHY76-02855 A01)

This experimental program will measure the coupling constants for the parity-non-conserving (PNC) weak e-p and e-n interactions in atomic hydrogen and deuterium. The rate of emission of Lyman-alpha from H and D will be measured for metastable beams passing suddenly through a static electric field. These decays result from both a Stark admixture and a weak PNC admixture of the 2P 1/2 state into the original 2S 1/2 state. The preferential absorption of right or left circularly polarized Balmer-alpha radiation in the 2S 1/2 yields 3S 1/2 transition will be measured for metastable beams of atomic H and D in crossed electric and magnetic fields. This absorption results from a nonresonant or suppressed Stark admixture and a resonantly enhanced weak PNC admixture of nearby P-states.

This work is a continuation of PHY76-02855.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0023, QUANTUM THEORY OF FIELDS
S.N. GUPTA, Wayne State University, School of Liberal Arts, *Detroit, Michigan* 48202 (EY-76-S-02-2302)

The research program will continue to deal with the development of basic theories of strong, weak, electromagnetic, and gravitational interactions as well as their applications to fundamental physical processes. In the near future, emphasis will be on mass splittings and mixing angles of hadrons, quantification of higher-spin fields with indefinite metric, and anomalies in non-weak and weak interactions.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Physical Research

8.0024, NUCLEAR PHYSICS PROGRAM
H.G. BLOSSER, Michigan State University, School of Natural Sciences, *East Lansing, Michigan* 48824 (PHY76-02206 A02)

This grant will provide continuation of support for the nuclear physics research program at Michigan State University and for studies in cyclotron design and related topics presently supported under NSF grant PHY76-02206 AO1. This program has centered around a sector focussed cyclotron which was designed and built at Michigan State with assistance provided originally by NSF grant GP-19978. A multifaceted research program in many areas of nuclear science, and ranging from nuclear astrophysics to magnet design, is carried out by experimental and theoretical physicists, nuclear chemists, and accelerator scientists.

A broad range of topics in nuclear physics, nuclear instrumentation, accelerator physics, and theoretical physics will be carried out. The nuclear physics topics can be treated under five main headings: Studies Related to Nuclear Isospin; Experiments Related to Astrophysics; Reaction Mechanisms and Average Nuclear Properties; Nuclear Spectroscopy with Direct Reactions; and Beta and Gamma Ray Spectroscopy. Studies of inelastic scattering, giant resonances, and charge dependent effects as well as a substantial program of shell-model calculations will be carried out.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0025, UNDERGRADUATE PHYSICS CURRICULUM REVISION
L.M. VALLEY, St. Johns University, Graduate School, *Collegeville, Minnesota* 56321 (SER76-16631)

Saint John's University will undertake a comprehensive, three-year revision of offerings in its undergraduate Physics Department. The proposed work is integral to Saint John's three- to five-year total curriculum revision which has already begun and which is of highest priority within the institution. The projected work will involve the department's four full-time faculty members in full-time work during parts of four summers and in one-quarter-time work during each of three academic years. A full-time faculty person will be added for two years to assume the responsibilities of regular faculty members freed for the project.

The goals and objectives of the project are to strengthen instructional ability in physics with the following, specific emphases: 1) develop in the faculty a more integrated view of the total physics curriculum for majors and non-majors; 2) for non-majors increased emphasis on the interrelationships between physics and other disciplines and to focus, whenever possible, on the integral role of physics in all disciplines; 3) assure an in-depth, rigorous coverage of physics for physics majors; and 4) develop a specific and effective plan for ongoing program evaluation and revision.

SUPPORTED BY U.S. National Science Foundation, Div. of Science Education Resources Improvement

8.0026, IMPROPER FERROELECTRICITY - A THEORETICAL AND EXPERIMENTAL STUDY 14221-P

J.R. HARDY, Univ. of Nebraska, School of Arts & Sciences, *Lincoln, Nebraska* 68508 (DA0E9251; DAAG29 77 G0008)

To elucidate the physical mechanism responsible for the ferroelectric transition in improper ferroelectrics. Relevance - the results of this research explore the mechanism for a new class of materials that have high potential in electrooptic application. GMO acts as an optical switch - its present applicability is limited because of its slow response time. The work is applicable to a broad range of electrooptical materials and as such supports the technological base of nonlinear optics and electrooptical materials.

The program combines a theoretical and experimental program. (1) Theory - the author will consider anharmonic interactions using self-consistent phonon theory to gadolinium molybdate (GMO) in addition to calculation of the lattice dynamics of complex structures like those of other improper ferroelectrics. Some candidate systems are the boracites, dicadmium sulfate and ammonium sulfate. (2) Experimental studies will consist of the measurement of the Raman and far-infrared spectra of these materials as well as a study of the effects of pressure (up to 50 kilobars) and temperature to elucidate mode-Gruneisen parameters.

ADDENDA: Supporting agency address is: DARCOM Army Research Office, Box 12211, Research Triangle Park, NC 27709

SUPPORTED BY U.S. Dept. of Defense, Army

8.0027, PHOTOIONIZATION OF ATOMS

J.A. SAMSON, Univ. of Nebraska, School of Arts & Sciences, *Lincoln, Nebraska* 68508 (EY-76-S-02-2892)

The experimental and theoretical study of atomic photoionization processes has advanced rapidly in the past decade so that both experimental and theoretical total photoionization cross sections in the vacuum ultraviolet region, at least for the rare gases, are possible with accuracies of plus or minus 10 percent. This accuracy makes possible the major objective of the proposed experimental and theoretical research program, which is to unravel the effects of electron correlation and of spin-orbit interaction on atomic photoionization processes. While the proposed research nevertheless requires the refinement and advancement of current techniques, the possibility of combined theoretical and experimental attack on these new research problems is a distinct benefit to both theory and experiment and increases the probability of obtaining significant results. Specifically, it is proposed to measure and/or calculate total and partial photoionization cross sections, photoelectron branching ratios and angular distributions, and multiple ionization cross sections either over an energy region of a few Rydbergs above threshold or over the narrow energy region of an autoionizing resonance. These studies will be carried out both for the rare gases as well as for less studied atoms, in particular open-shell atoms. Among the atoms for which experimental work is proposed are He, Ar, Xe, Hg, and O. Among the atoms for which theoretical work is proposed are Ne, Ar, Xe, and Cl. In addition, photoionization of hydrogen-like atoms in high laboratory magnetic fields will be studied theoretically.

RESULTS: Random phase approximation calculations for photoionization of an open-shell atom have been carried out for atomic chlorine. Virtual double excitations in the ground state, which influence rare gas photoabsorption cross sections significantly, do not play as important a role in atomic chlorine due to an averaging out of these effects among many final state channels. Photoelectron angular distribution have been calculated for the outer (open) shells of the halogens and the chalcogens and it is found that anisotropic electron-ion interactions are strongest in the second row of the periodic table. Experimentally, a rotatable vacuum UV polarizer and a fixed electron energy analyzer have been designed and built to measure the photoelectron angular distribution of atomic oxygen at 584 A. (Text Abridged)

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Physical Research

8.0028, MOSSBAUER EFFECT STUDIES IN CHEMISTRY AND SOLID-STATE PHYSICS

R.H. HERBER, Rutgers the State University, School of Chemistry, *New Brunswick, New Jersey* 08903 (DMR76-00139 A01)

This grant will provide partial support for two distinct but closely related studies, both utilizing Mossbauer effect methodology in the elucidation of the structure, bonding and solid-state properties of organometallic molecules and related compounds.

In the first part, the effective vibrating mass model (EVM) proposed earlier, which permits a correlation between Raman active lattice vibrational modes and the temperature-dependence of the recoil-free fraction (Mossbauer Debye Waller factor) observed in Mossbauer experiments, is extended and subjected to a critical test by isotopic substitution in SnH_4.

In the second part, Mossbauer effect spectroscopy is used to study the lattice dynamics, vibrational anisotropy, bonding and charge distribution in an important new class of materials, the intercalated layer compounds of TaS2 and related transition-metal dichalcogenides. Such studies are expected to elucidate the interaction between the intercalated molecule and the host material, and in this manner provide a new and unique probe into the solid-state properties of these metallic and semiconductor materials.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0029, STUDY OF ELASTIC AND INELASTIC SCATTERING OF ELECTRONS BY ATOMS

D.C. CARTWRIGHT, Los Alamos Scientific Lab., *Los Alamos, New Mexico* 87544 (INT75-19305)

This cooperative research program involves the development and implementation of an ab initio theoretical method that will reliably predict the differential and integral cross sections for the elastic and inelastic scattering of medium energy electrons, by closed shell and spin-degenerate atoms. One of the goals of this research is to be able to explain the anomalies recently observed experimentally in electron-metal vapor experiments and to aid the experimental program in obtaining absolute cross sections. The other goal is to be able to predict reliable differential and integral cross sections in the energy region above threshold for those systems of importance that cannot be studied experimentally. In addition to providing a theoretical technique which is applicable to an energy region where there is little capability beyond first order-type methods, the results from this research will provide results that can be of immediate use in studies of metal vapor lasers and plasma studies involving alkali-type elements. The research will be carried out cooperatively by the Los Alamos Scientific Laboratory and the Instituto de Fisica of the University of Campinas, Brazil.

SUPPORTED BY U.S. National Science Foundation, Div. of International Programs

8.0030, ULTRAFAST PHENOMENA IN SOLID-STATE PHYSICS AND OPTICAL PHYSICS
R.R. ALFANO, City University of New York, School of Liberal Arts & Sci., *New York, New York* 10031 (DMR73-02392 A02)

The research program on ultrashort phenomena in liquids, solids, and optical physics which previously was supported by NSF grant DMR-7302392, will be continued. This program will be directed toward developing an insight into the mechanisms behind molecular energy transformations in liquids and solids and to developing a better understanding of ultrashort pulse propagation in materials. Particular investigations include studies of the: excitation of vibrational states of solvent molecules via the nonradiative decay of optically excited dye molecules; heterofission of singlet states of dye molecules; heterofission of singlet states of dye molecules in liquids; rotational and vibrational relaxation times in pure and mixed liquids; coherent effects in Raman pulse propagation; nonlinear optical effects in magnetic crystals; kinetics of elementary excitations in semiconductors and magnetic crystals; kinetics of homofission and heterofission of excitons in molecular crystals and excitons interactions in semiconductor CdS: and, properties of nonequilibrium distribution of optical phonons will be studied in different stimulated Raman regimes.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0031, THEORY OF DISORDERED SOLID-STATE SYSTEMS
J.M. LUTTINGER, Columbia University, School of Arts & Sciences, *New York, New York* 10027 (DMR77-06716)

Theoretical studies of disordered solid-state systems previously supported by DMR-7509939 will be continued. A combination of various mathematical methods will be used including path integrals, variational techniques and exactly soluble models. The emphasis of the previous research has been on equilibrium properties such as heat capacity, diamagnetism and phase transitions. The methods will be developed further to include non-equilibrium properties such as electrical conductivity. The latter is of especial interest because of its connection to the 'Mott' problem; that is, the transition from localized to non-localized states. Another direction of this research will include the study of collective excitations of disordered systems, particularly in relation to the well-known low-temperature specific heat anomaly in spin-glasses.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0032, THEORETICAL HIGH-ENERGY PHYSICS
N.N. KHURI, Rockefeller University, Graduate School, *New York, New York* 10021 (EY-76-C-02-2232A)

Investigations of fundamental particle processes, high-energy behavior of scattering amplitude, symmetries of strong, electromagnetic, and weak interactions, quantum field theory.

Part 1 of 6.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Physical Research

8.0033, THEORETICAL STUDY OF SOLID ELECTROLYTES (SUPER-IONIC CONDUCTORS)
S. CHOI, Univ. of North Carolina, School of Arts & Sciences, *Chapel Hill, North Carolina* 27514 (DMR76-04009)

Ionic crystals such as beta-alumina and RbAg4I5 (rubidium silver iodide) have unusually high ionic electrical conductivity and can be used as electrolytes in high-energy-density electric storage batteries. These super-ionic conductors are intellectually challenging as well because of many unexplained relationships between their microscopic structures and high ionic conductivity. In order to find such relationships and help find new electrolytes, the following theoretical investigations are being carried out. (A) Interaction energies of defects and impurities with carrier ions are calculated by the polarizable ion model in beta-alumina. (B) The effect of defects and impurities are being incorporated into the theory of ionic conductivity. (C) A theory of infrared spectra of beta-alumina based on a transition moment calculation is being worked out. (D) Binding energies of some alkali ions and transition metal ions on beta-alumina and a simple cubic solid electrolyte surface are being calculated with special consideration given to the effect of mobile ion distribution.

This is a continuation of research supported under DMR-7307577.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0034, NUCLEAR REACTION STUDIES IN LIGHT NUCLEI
R.E. WARNER, Ober'in College, School of Arts & Sciences, *Oberlin, Ohio* 44074 (PHY77-01348)

Experiments aimed at elucidating the structure of light nuclei, and the reaction mechanism of helium-three reactions, will continue. The data consisting of simultaneous measurements of the momenta of two particle products of nuclear reactions are sufficient to determine whether clusters of nucleons with structure similar to deuterons, tritons, or alpha particles pre-exist in lithium or beryllium nuclei. The results test theoretical predictions based on assumed properties of the nucleon-nucleon force.

This work is a continuation of that supported by Foundation grant PHY74-04845 AO2.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0035, COLLABORATIVE RESEARCH ON NUCLEAR PHYSICS AT INTERMEDIATE ENERGIES
D.K. MCDANIELS, Oregon State Higher Educ. Sys., School of Liberal Arts, *Eugene, Oregon* 97401 (PHY76-81858)

Inelastic proton scattering studies will be conducted at 800 MeV using the High-Resolution Spectrometer at LAMPF and at 200-550 MeV using polarized protons and a magnetic spectrometer presently being developed at TRIUMF. Information is sought on the effective interaction to be used in the analysis of proton interactions with nuclei and on the aspects of nuclear structure which are best studied using medium-energy protons.

In addition the group will collaborate with Oregon State University in a wide-ranging program to study pion interaction with nuclei.

This work is a continuation of that previously supported under Foundation grant PHY73-05248 A02.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0036, THEORETICAL RESEARCH IN SOLID-STATE AND SURFACE PHYSICS
J.R. SCHRIEFFER, Univ. of Pennsylvania, Graduate School, *Philadelphia, Pennsylvania* 19101 (DMR76-81602)

Theoretical research in solid-state physics previously supported by NSF grant DMR73-07682 A03 will be continued. The primary focus of the research will be in the area of surface physics with, however, a shift of emphasis from applying one-electron self-consistent field type theories to theories which accurately handle exchange and correlation effects in the strongly inhomogeneous electron systems encountered in surface physics problems. Some effort will continue on efforts to improve and apply one-electron methods for handling such problems, particularly in relation to interpreting experimental work concerning surface spectroscopies. In addition, problems of nonlinear excitations in lattice and coupled electron-lattice systems will continue to be studied.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0037, STUDY OF SURFACE EFFECTS INDUCED BY LIGHT IONS IN THERMONUCLEAR REACTORS
B. NAVINSEK, Univ. of Ljubljana, J. Stefan Institute, *Ljubljana, Soc. Fed. Rep. of Yugoslavia* 61001 (1761/R1/RB)

Radiation blistering and light ion erosion of fusion first walls are important engineering problems of future fusion reactors.

This research contract (for the second year) includes investigations of surface changes induced by He ions on stainless steels and nickel-rich alloys including Hastelloy and Inconel, as the materials of special interest to the JET programme.

Surface changes under the following conditions are studied: ion energies 3-15 keV, ion doses 10 to the 16th power-10 to the 19th power ions/square cm and target temperatures 20-650 degrees C.

Repeated bombardments at various temperatures to simulate fusion reactor conditions are also included in the programme.

SUPPORTED BY International Atomic Energy Agency

8.0038, BUBBLE CHAMBER STUDIES OF HADRON PHOTON INTERACTIONS

W.M. BUGG, Univ. of Tennessee, School of Liberal Arts, *Knoxville, Tennessee* 37916 (EY-76-S-05-3956)

Presently one group is involved in six major experiments. The first is a FNAL hybrid bubble chamber experiment (FNAL No. 154), a 100K negative pion p exposure at 147 GeV/c. It is in the final publication stage. A continuation (FNAL No. 299) has taken 240,000 pictures of 147 GeV/c positive pion, K ion and p and will take an equal number this summer. Next, measurement is complete on half a million picture exposure of positive pion d at 15 GeV/c (collaboration with Florida State) and almost complete on our share of a 1.5 million picture exposure of negative pion p at 8 GeV/c in collaboration with M.I.T. and Tohoku (Japan). Three new experiments have been approved. They include an antiproton-D exposure in the 0-800 MeV/c range in the Argonne 12' chamber, a hybrid 40' positive pion-d experiment at SLAC, and a 4.1 GeV/c antiproton-p exposure in the Argonne T.S.T. The antiproton-D is presently being measured and the other two will be run this and next year. We continue to work on upgrading the FNAL and SLAC hybrid systems and on our data processing and program systems.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Physical Research

8.0039, CONFERENCE ON ATOMIC PHYSICS OF HIGH-TEMPERATURE PLASMAS, FEBRUARY 16-18, 1977

C.F. BARNETT, U.S. Energy Res. & Dev. Admin., *Oak Ridge, Tennessee* 37830 (PHY76-81639)

This conference will bring together leading scientists in the fields of astrophysics, high-temperature plasma physics, and atomic phenomena at high energies, to provide a forum in which the progress of the past few years can be discussed. The talks will range from the basic aspects of atomic physics to their applications to fusion research.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0040, INTERMEDIATE-ENERGY NUCLEAR PHYSICS STUDIES

G.C. PHILLIPS, Rice University, Graduate School, *Houston, Texas* 77001 (EY-76-C-05-1316)

The objective of the proposed research is the experimental study of nuclear structure and reaction mechanisms at intermediate energies. Pions will be used to probe the structure of complex nuclei by measuring the total inelastic pion scattering spectrum for energies spanning the pion-nucleon (3,3) resonance (IC-540, SREL). In addition, a measurement of the total charge exchange cross section (negative pion, neutral pion) will be simultaneously collected by observing the gamma rays from the neutral pion decay. Also, pion induced breakup of deuterium with and without pion production will be studied in a two-arm coincidence measurement (E-82) (LAMPF). Depending on beam schedules, work may begin on the investigation of multiwire proportional counters (MWPC) for use in treatment volume visualization (E-83 LAMPF).

The work will be carried out at SREL & LAMPF. The principal equipment to be used will be the Rice University Portable Laboratory which houses a PDP 11/45 computer, a 1000-wire MWPC system, detectors, and associated electronics.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Physical Research

8.0041, ENERGETICS OF ATOMIC AND MOLECULAR INTERACTIONS

G.K. WALTERS, Rice University, Graduate School, *Houston, Texas* 77001 (EY-76-S-05-4676)

This program emphasizes studies of structure and interactions of excited atoms, molecules, electrons and ions in both gases and liquids, as well as properties of and atomic interactions with solid surfaces. The program is oriented toward basic problems of relevance to the nation's energy program. Specific areas of current activity include studies of reactions and radiative lifetimes in atomic and molecular systems of high-efficiency laser promise (of interest for laser fusion, laser isotope separation), new approaches (both experimental and theoretical) to the study of solid surfaces, and ultimately heterogeneous catalysis, and understanding of spectra and collisional effects of general interest in plasma physics and controlled thermonuclear reaction technology.

The program involves 1) the use of electron (e-beam) bombardment and time-resolved spectroscopy in the study of transient excited species in dense gases of laser importance; 2) new approaches to the study of atomically clean crystalline surfaces, and their interaction with ambient gases; 3) development of tunable ultraviolet lasers; 4) theoretical studies of collision processes involving electrons, ions, atoms and molecules.

RESULTS: 1) Radiative lifetimes and reaction rates in dense rare gases and their mixtures (important to modeling and optimizing rare gas lasers); 2) Demonstration of sizable spin-polarization in low-energy electron diffraction from clean surfaces (important as a new diagnostic for surface analysis, perhaps ultimately to heterogeneous catalysis); 3) advances in tunable dye laser technology; 4) theory of atomic and molecular collision processes and ion- and atom-surface interactions.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Physical Research

8.0042, MICROSTRUCTURAL STUDIES OF HYDROGEN AND DEUTERIUM IN BCC REFRACTORY METALS

S.C. MOSS, Univ. of Houston, School of Natural Sci. & Math., *Houston, Texas* 77004 (EY-76-S-05-5111)

We propose to employ diffuse and Bragg X-ray scattering, elastic and inelastic neutron scattering, gamma-ray Compton scattering and, in collaboration with Professor S. Berko, positron annihilation to the study of the microstructural aspects of dissolved interstitial hydrogen and deuterium in selected BCC refractory metals. The dominant interactions of hydrogen with these metals is both elastic, via the displacement strain field, and electronic via screening effects and the modification of the host lattice Fermi surface. Our studies will concentrate on: a) the details of the elastic interaction using diffuse (Huang) and Bragg X-ray scattering; b) the nature of the D-D interaction using neutron scattering in concentrated disordered alloys; c) the study of electronic effects using Compton scattering and positron annihilation determinations of the details of the Fermi surface in moderately concentrated alloys; and d) the influence of H(D) defects on phonon dispersion and on the initiation of structural phase transitions - in particular the omega phase. The X-ray scattering will concentrate on H and D in Ta and V. The Compton work will involve anisotropy determination in V and V-D solutions. The neutron work will be on concentrated V-D solutions and on Ta-D alloys and the positron studies will involve H or D in Ta.

RESULTS: Data on concentrated H-Ta solutions have been analyzed to show the absence of clustering and the application of the single defect approximation to the elastic displacement field around H. X-ray equipment is being set up to extend these results to other systems and gamma-ray Compton scattering is underway on the V-D system. Crystals have been prepared and are being loaded for neutron studies of V-D above the ordering temperature.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Physical Research

8.0043, MAGNETIC RESONANCE STUDY OF ATOMIC AND MOLECULAR MOTIONS

D.C. AILION, Utah Higher Education System, School of Science, *Salt Lake City, Utah* 84112 (DMR76-18966)

The program of investigation of atomic and molecular motions by means of nuclear magnetic resonance previously supported by NSF grant DMR72-02924 will be continued. Recent theoretical and experimental work of the principal investigator and previous students suggests that under appropriate conditions it may be possible to use NMR to distinguish between different diffusion mechanisms. Previously, this work verified experimentally these ideas for the case of Cl vacancy diffusion. These experiments will be extended to cases in which other types of diffusion dominate. A study of the diffusion of interstitial F ions in pure and doped CaF2 single crystals has been completed. These measurements will be extended to CaF2 crystals doped with Na ions, in which F vacancies dominate. Calculations of the angular dependence of the low-field rotating frame relaxation time for different modes of reorientation of the NH4 ions in NH4Cl have been completed. Also, the temperature and angular dependence of T1 have been measured. These techniques will be applied to a study of rotation in more complicated systems, like trans-trans muconodinitrile and para-terphenyl, which have an energy profile having several shallow minima corresponding to different orientations of the molecule. Techniques are being developed for combining ultra-slow-motion methods with double resonance for the purpose of studying the motions of weakly magnetic or dilute spins directly. NMR relaxation time measurements will be used to study ionic diffusion in solid electrolytes, like sodium beta and beta' alumina. Because of the very high conductivity of Na ions in beta and beta' alumina, these substances have a variety of applications in problems where energy conversion is important.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0044, THEORETICAL STUDIES OF CHEMICAL REACTIONS INVOLVING EXCITED ELECTRONIC STATES

J.B. DELOS, Coll. of William & Mary, School of Arts & Sciences, *Williamsburg, Virginia* 23185 (CHE75-16119)

Theoretical studies of chemical reactions involving excited electronic states are planned. The work is divided into two areas: reactions involving individual discrete excited states, and reactions involving ionization and electron detachment (a continuum of excited states). Research into the chemistry of negative ions will focus on the development of theoretical methods for analyzing these reactions, and the application of these methods to simple ion-atom collisions. A general theory is already available for calculating the probability of electron detachment, the electron energy spectrum, and the total detachment cross section; this theory will be compared with the experimental measurements. Further analysis is needed to study the threshold effects in the elastic differential cross section, and the angular distribution of detached electrons. After the theory has been developed and tested on ion-atom collisions, it will be applied to analyze and interpret the results of ion-molecule collision experiments. The studies of discrete excitations are now in an advanced stage, thus a comprehensive review article to summarize and evaluate recent work is planned.

SUPPORTED BY U.S. National Science Foundation, Div. of Chemistry

8.0045, NATURE OF POINT DEFECTS IN III-V COMPOUNDS

A. SHER, Coll. of William & Mary, School of Arts & Sciences, *Williamsburg, Virginia* 23185 (DMR76-80552)

Nuclear magnetic resonance measurements of small concentrations (approximately 10 to the 14th power per cc) of charged defects in II-V compounds will be made. The radiation damage and thermal damage experiments will be extended and the measurement accuracy of the electron-coupled nuclear interaction in III-V compounds improved. The effects of externally applied electric fields on the resonance frequency will be measured. Some improvements will be made in the lineshape theory, and experimental sensitivity will be enhanced by double resonance techniques.

A two-electron bond-orbital model has been developed that successfully predicts a number of parameters in III-V compounds; dielectric constant, electron-coupled nuclear interactions, valence electron density, polarity of the bond, and cohesive energy. The agreement with experiment will be improved by fitting to the valence electron charge density experiments; extending the theory to II-VI compounds; and coupling the theory with a coherent potential approximation calculation in order to treat III-V ternary alloys.

Reference: DMR73-02365.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0046, CO2 LASER INTERACTION WITH MAGNETICALLY CONFINED PLASMAS

Z.A. PIETRZYK, Univ. of Washington, School of Engineering, *Seattle, Washington* 98105 (EY-76-S-06-2225 TA 28)

This proposal is to continue work started in 1969 on the interaction of intense CO2 laser radiation with magnetically confined plasmas.

The principal tasks are: a) to investigate beam trapping, wave propagation and plasma heating in 50 cm quasi-steady solenoid; b) to investigate the concept of 'laser-staging' (i.e., the combination of laser heat addition and magnetic compression) in fast solenoids; c) to investigate the heating by CO2 laser illuminating both sides of the solenoids; d) to investigate the dynamic end stopping; e) to measure the laser beam diameter in plasma; and f) to support and complement the experimental work with appropriate theoretical modeling.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Laser Fusion

8.0047, VOID NUCLEATION AND GROWTH IN HEAVY ION AND ELECTRON BOMBARDED PURE METALS

G.L. KULCINSKI, Univ. of Wisconsin, School of Engineering, *Madison, Wisconsin* 53706 (EY-76-S-02-2206)

The object of this work is to study the factors which govern the nucleation and growth of voids in pure metals during high temperature bombardment with high energy heavy ions and electrons. It is also to use very precise length change measurements to measure basic defect properties in electron irradiated pure metals. The results from this work will be used to develop theoretical models of the microstructural development during high temperature irradiations. Transmission electron microscopy will be used to determine the number, size, morphology and distribution of voids, dislocation loops, and precipitates in pure Al and V as well as V-N alloys. The irradiation will be conducted from RT to 200 degrees C for Al and from RT to 900 degrees C for V and V-N. High-energy (15-20 Mev) heavy ions (Al, V, Ta, and Cu) will be used to produce the high-temperature damage. This work will also be supplemented by 1 Mev electron bombardment in a HVEM. The measurement of length changes in isochronally annealed Mo, Au, Cu and Ag should lead to a unique assignment of the various mechanisms for defect removal after low-temperature (4 degrees K) irradiation.

RESULTS: The resistance of V to swelling in the 200-750 degrees C 2 dpa region has been developed and a fluence dependency from 0.1 to 5 dpa at 700 degrees C has been established. Initial irradiation of a V-1% N alloys shows that the void density is lower and the void size is larger than in similarly irradiated pure V. No V-N precipitates were observed up to 2 dpa at 600 degrees C. Two Mev aluminum bombardment of Al to 8 dpa temperatures up to 200 degrees C does not produce voids unless helium is present. No voids have yet been found in Al irradiated with 15-20 Mev heavy ions (without He) from 100-200 degrees C up to 6 dpa nor in 1 Mev electron irradiated Al (with or without He) from RT-200 degrees C up to 8 dpa.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Physical Research

SOCIAL SCIENCES

Includes Social Sciences (general); Administration and Management; Documentation and Information Science; Economics and Cost Analysis; Law and Political Science; and Urban Technology and Transportation.

9.0001, APPLICATIONS OF HEAT CAPACITY MAPPING MISSION SATELLITE DATA TO THE STUDY OF URBAN HEATING PATTERNS
R.J. LYON, Stanford University, School of Earth Sciences, *Palo Alto, California* 94305 (NAS 5-24232)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, ASTRONOMICAL POLARIZATION
A.M. GEHRELS, Univ. of Arizona, School of Liberal Arts, *Tucson, Arizona* 85721 (AST76-07685 A01)

By means of measuring the polarization of ultraviolet, visible, and infrared light, it is possible to analyze the character of the light scattered by atomic, molecular, and particulate material. From this, one can determine the chemical and physical nature of such interstellar material from which stars and planets are made.

Shells of gas and dust around stars in our galaxy will be observed to determine the sizes, densities, and temperatures of the particles being expelled by these supergiant stars. A recently completed spectrometer-polarimeter will be used to refine the observations and determine how much of the polarization is produced by the stars themselves as opposed to being produced in the surrounding shell.

Known sources of X-ray radiation will be observed for polarization, which in this case indicates the presence of a strong magnetic field.

Venus, Saturn, and Uranus will be studied in a joint program with collaborators in NASA and the Meudon Observatory in France. The aim will be to better define the structure and composition of the atmospheres of these planets. For Venus it may be possible to define the size ranges of the sulfuric acid droplets which make up the upper cloud layers.

This is a continuation of research supported under NSF Grant AST 76-07685.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0002, THEORETICAL STUDIES OF SOLAR OSCILLATION
P. GOLDREICH, Univ. of Arizona, Graduate School, *Tucson, Arizona* 85721 (NSG 7342)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

10.0003, LABORATORY STUDY OF NEUTRAL POINT SOLAR FLARE PROCESSES
R.S. WHITE, Univ. of California, School of Physical Sciences, *Riverside, California* 92502 (ATM76-23463)

The primary objective of this grant is the experimental investigation of the dynamic behavior of plasmas in the neighborhood of an x-type magnetic neutral point, and the process of reconnection of magnetic field lines. The purpose of this effort is to clarify the physical processes that take place in solar flares, substorms of the earth's magnetosphere, and other manifestations of plasma dynamic behavior and field line reconnection in complex magnetic field systems containing x-type magnetic neutral points.

The investigators will study magnetic field line reconnection with a flat plate Double Inverse Pinch Device (Mark IV) and three-dimensional, double-dipole configurations. They measure the fluxes and energy spectra of accelerated ions and electrons, optical, microwave, and x-ray radiations, the magnetic field line configurations, reconnection rates, and energy dissipation rates. A major effort will be made to determine the conditions required to produce the remarkable transitions from ohmic to turbulent conductivity which have been observed. These sudden conduction mode transitions produce many phenomena that correspond to those in solar flares and magnetospheric substorms.

The overall aim of this work is to understand the process of magnetic reconnection and how it relates to realistic models of the solar flare and the magnetosphere substorm.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

10.0004, DIGICON ASTRONOMY
E.A. BEAVER, Univ. of California, Graduate School, *San Diego, California* 92037 (AST75-21551 A01)

Detailed spectrophotometric and spectropolarimetric studies will be made of white dwarf stars using a new digicon (digital imaging) system. Goals include 1) placing more stringent limits on the abundances of metals (elements with Z less than 6) in the atmosphere of DA, DB and DC white dwarfs, 2) examining the line strengths and profiles in the cooler white dwarf stars resulting in model atmosphere analysis, and 3) obtaining the wavelength dependence of polarization in white dwarfs and interpreting these data in terms of influence of magnetic fields on line, band and continuum opacities. Time variations of polarization and its correlation with spectral changes will be studied.

The digicon system will be used to determine red shifts for faint galaxies, a project for which the instrument is uniquely suited. The results will advance understanding of the nature of the radio source phenomenon. Red shifts and hence distance determinations are crucial for such studies.

Surface photometry of galaxies will be undertaken with the digicon system. These data will outline the extent of the individual galaxies. A search will be made for the vast outer halos postulated by Ostriker and his colleagues. If present, these halos would provide sufficient material to close the universe.

This action provides additional funding and extends the duration of the grant number AST75-21551 for 12 months.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0005, A PUBLIC TELEVISION PROGRAM - THE EXPANDING UNIVERSE
B. SHAPIRO, Conn. Public Television, *Hartford, Connecticut* 06106 (OSS76-81592)

This project is the 'pilot program' for a new series of one hour public television specials dealing with important discoveries of American scientists. The program will go beyond a simple biography to also develop the audience's awareness of the processes and excitement of science as well as the reciprocal relationship between science and society. A second objective is to perform a historical service by collecting important audio-visual records which will be turned over to the Nils Bohr Library of the American Institute of Physics where it will be available to the public.

The program will discuss the pioneering work of Edwin Hubble, attorney turned astronomer, who first revealed that the universe was billions of times larger than had been expected and was growing still larger with galaxies rushing away from earth as well as from each other at enormous speeds. These dramatic discoveries, among the most important in the history of science, began a period of fifty years during which astronomy progressed from a stage of observation to the examination of complex questions about the origin and fate of stars and galaxies as well as the basic physical forces operating in the universe.

The program will be shown over the five-station Connecticut Public Television network and offered to the PBS network. At the same time it will serve to indicate the potential impact and audience for a series of this type.

SUPPORTED BY U.S. National Science Foundation, Office of Science & Society

10.0006, RELATIVISTIC ASTROPHYSICS AND GRAVITATION THEORY
D.M. EARDLEY, Yale University, Graduate School, *New Haven, Connecticut* 06520 (PHY76-82353)

With the probable discovery of black holes by X-ray astronomers, Einstein's general relativity has become even more an

indispensable part of astrophysics, in addition to its role as a successful physical theory. The Yale group will conduct a many-sided investigation of the theory and its astrophysical applications. They plan to calculate X-ray emission by hot plasma near a black hole, especially through inverse Compton scattering, which probably dominates in the source Cyg X-1. In particular they plan to refine the hot disk model, and also formulate models for X-ray sources in globular clusters. Several well-posed problems on fluid disks and flows near a black hole will be investigated.

One of the most challenging open problems is to understand in detail the gravitational collapse of a non-spherical stellar core to a black hole or neutron star. Here, they will also carry out theoretical investigations of perturbation theory and the initial-value problem, some of which will apply to collapse.

They will explore further tests of the principle of equivalence, the cornerstone of Einstein's theory, by observations of orbits of neutron stars, notably PSR 1913 plus 16. Quantum particle creation by gravitational fields will be studied.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

10.0007, THE DYNAMICS OF GRAVITATING SYSTEMS
C. HUNTER, State University of Fla. Sys., School of Arts & Sciences, *Tallahassee, Florida* 32306 (MCS75-06177 A02)

This is a continuation of research previously supported under GP-34279X2.

C. Hunter will continue his development of the mathematical theory of stellar systems. In particular, he will work on several problems relating to the formation, structure and stability of stellar systems. The first area is that of the Ostriker-Peebles criterion, which states that gravitating systems are unstable if more than about 28% of their kinetic energy is in the form of mean rather than random motions. Although there is substantial evidence in favor of this criterion, it is not yet fully established, and deserves further study because of its profound implications. The second area is that of constructing collisionless self-consistent stellar dynamic models of elliptical and barred galaxies. The third area is the study of the mechanisms by which angular momentum can be transferred between different parts of galactic disks. The fourth area is that of the fragmentation process by which stars and galaxies are presumed to form.

SUPPORTED BY U.S. National Science Foundation, Div. of Mathematical & Computer Sciences

10.0008, A NUMERICAL STUDY OF RESONANCE EFFECTS ON TIDAL EVOLUTION OF SATELLITE ORBITS
H.C. SMITH, State University of Fla. Sys., School of Natural Sciences, *Tampa, Florida* 33620 (NSG 1420)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

10.0009, ASTRONOMICAL DETECTOR DEVELOPMENT
T.B. MCCORD, Univ. of Hawaii, Graduate School, *Honolulu, Hawaii* 96822 (AST76-81803)

The Mauna Kea Observatory of the University of Hawaii is recognized as one of the finest sites for astronomical observations in the world. The University of Hawaii has a 2.25 meter telescope on the site. In order to use such a telescope most efficiently, it must be equipped with the best possible devices for detecting and recording the faint signals coming from the distant stars and galaxies.

During the coming year a modern detector system of proven design will be interfaced to the Hawaiian telescope and its various control and data handling system for laboratory use will also be constructed. A small amount of work on the testing of the new CCD (charge coupled device) imaging systems will be initiated toward the end of the grant year.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0010, A STUDY OF THE VERY LONG BASELINE INTERFEROMETRY (VLBI) NETWORK
G.W. SWENSON, Univ. of Illinois, School of Engineering, *Urbana, Illinois* 61801 (AST76-24650)

Very Long Baseline Interferometry (VLBI) is a technique where several widely spaced radio telescopes can be operated together to resolve the finest details in celestial radio sources.

A study will be conducted to: Examine the performance of the present telescopes which are currently being used together as a unified network. Develop a quantitative measure of the quality of any given network. Evaluate by means of this quality criterion the best location for an antenna which would enhance the performance of the present network. Examine sites and types of suitable antenna designs for a possible new VLBI telescope.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0011, FLARES ON DEGENERATE STARS
G. CHANMUGAM, Louisiana State Univ. Systems, School of Chemistry & Physics, *Baton Rouge, Louisiana* 70803 (AST76-06807)

A number of rapid transient phenomena have recently been observed at x-ray and gamma-ray wavelengths. It has been hypothesized that these phenomena are due to sudden outbursts on the surface of white dwarf and neutron stars. The study of flares on such stars will require an examination of (a) the magnetohydrodynamic instabilities in degenerate matter in the presence of strong magnetic fields; (b) the development of the instabilities leading to the flare outburst; and (c) a study of the radiation mechanisms for the flares.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0012, SOLAR RADIATION MEASUREMENT PROJECT
J. IOUP, Xavier University of Louisiana, School of Arts & Sciences, *New Orleans, Louisiana* 70125 (NSG 8050)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

10.0013, LONG BASELINE INTERFEROMETRY OF THE SUN AT CENTIMETER WAVELENGTHS
M.R. KUNDU, Univ. of Maryland, School of Engineering, *College Park, Maryland* 20740 (ATM76-22415)

This grant will continue the use of long baseline interferometers to observe the fine structure of the radio emissive regions on the Sun at centimeter wavelengths. The observations will be devoted to the study of the fine structure of the quiet Sun such as limb brightening and spicules, of active regions and of flare-associated burst sources. Such studies will be important for models of the chromosphere and for understanding the mechanism of generation of radio emission from active regions and flares. Several interferometers will be used for this study: the NRAO (National Radio Astronomy Observatory) four-element interferometer at 3.7 and 11.1 cm, the Hat Creek interferometer at 1.3 cm, the Stanford five-element array at 2.8 cm, and the Westerbork synthesis radio telescope at 6 and 21 cm. In particular, the Westerbork telescope will be used in an attempt to synthesize super-granulation networks at 6 cm. It will also be used to study the structure and position of the sources that produce transient brightenings of a few minutes' duration.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

10.0014, THEORETICAL STUDIES IN NUCLEAR SYNTHESIS AND ASTROPHYSICS
A.G. CAMERON, Harvard University, School of Arts & Sciences, *Cambridge, Massachusetts* 02138 (AST76-81572)

The high abundance of deuterium observed in the solar system has been used as evidence to indicate that the mean density of matter in the universe is low. This in turn may imply that we live in an open, rather than closed, universe. However, it is possi-

ble that the observed deuterium abundance may have had a non-cosmological origin. It has been proposed that the observed deuterium is formed in a supernova explosion. Some aspects of nucleosynthesis taking place in supernovae will be examined in order to study the possible consequences of these reactions on the formation of deuterium in the galaxy. A second part of the research will involve an examination of the physical processes taking place during the birth of a star.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0015, PROBLEMS IN PLASMA ASTROPHYSICS
R.M. KULSRUD, Princeton University, Plasma Physics Laboratory, *Princeton, New Jersey* 08540 (AST76-80800)

The topics to be investigated involve the application of plasma physics to astrophysical problems. Problems to be studied are the theory of the escape of cosmic rays from supernovae, the analysis of other possible sources of cosmic rays such as rotating white dwarfs, conditions under which the breaking and reconnection of magnetic lines of force may occur in highly conducting fluids, the pulsar origin of cosmic rays, stochastic acceleration of charged particles by hydromagnetic turbulence, theories of cosmic ray propagation, and the origin of interstellar scintillations. This is a continuation of work previously supported by NSF Grant AST 73-04579A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0016, PLASMA DIAGNOSTICS OF GIANT NONTHERMAL EMISSION NEBULAE
S.J. CZYZAK, Ohio State University, School of Math. & Phys. Scis., *Columbus, Ohio* 43210 (AST76-15727)

The Tarantula Nebula (30 Doradus) is the brightest of the gaseous nebulae in the nearby galaxy, the Large Magellanic Cloud, seen in the southern sky at a distance of approximately one hundred seventy thousand light years. The nebula is larger than any emission nebulosity optically observable within our own Milky Way Galaxy. Several astronomers have suggested that 30 Doradus is analagous to the emission cores of galaxies. Both a strong radio source and the core of our galaxy, believed to be radiating in a manner similar to 30 Doradus, are hidden from view by dust clouds. A detailed investigation will be undertaken of the structure of 30 Doradus with emphasis on the dimensions, densities and temperatures of the individual knots and filaments. An assessment will be made of the total mass and the origin of the continuous radiation in the optical wavelength range. Spectrographic observations obtained by M.G. Smith of the Cerro Tololo Interamerican Observatory in Chile will be used. Optical evidence for the distribution of non-thermal emission will be compared with the radio frequency data to see if the sources are the coincident. Additional direct photographs and spectra will be obtained at Cerro Tololo. Observational material will also be obtained at the Hale and Lowell Observatories of the only known optical counterpart of 30 Doradus, NGC 604 in the Triangulum spiral galaxy, two million light years away and thus much fainter. Its characteristics will be related to those of 30 Doradus as a first step in the comparison with ionized hydrogen (HII) regions in other galaxies.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0017, PHYSICAL NATURE OF COMETS
A.H. DELSEMME, Univ. of Toledo, School of Arts & Sciences, *Toledo, Ohio* 43606 (AST76-07116)

Brightness profiles of different molecular, ionic and atomic emissions in comets will be obtained from spectra obtained either from ground-based observatories (in Toledo or elsewhere), or from space as far as the atomic resonance lines are concerned.

Coma models yielding quantitative production rates and molecular, ionic or atomic lifetimes against decay will then be deduced from the observed brightness profiles.

In order to elucidate the origin of comets, work will be undertaken using elemental solar abundances, to compute theoretically the chemical mixture for all temperature and pressure conditions that seem possible in the primeval solar nebulae, and to find out whether a condensate of such a mixture could yield the observed molecules in their observed abundances.

Prior support was by NSF grant AST 72-05168 A03.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0018, REDUCTION, ANALYSIS AND PUBLICATION OF GAMMA-RAY ASTRONOMY DATA
R.C. HAYMES, Rice University, Graduate School, *Houston, Texas* 77001 (AST76-22669)

The reduction, analysis and publication of existing gamma-ray astronomy data will be completed. The data contains new information on the energy spectra of the pulsed hard radiation emitted by the globular cluster NCC 6624, a possibly unique object in Scorpius, the Vela pulsar and the x-ray nova in Taurus. The pre-discovery data include spectra in the energy interval from 0.03 MeV to 12 MeV. They will provide higher-energy information than available from x-ray astronomy observations and will therefore be important in constructing theories of these objects.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0019, PROBLEMS IN STELLAR EVOLUTION
R.T. ROOD, Univ. of Virginia, School of Arts & Sciences, *Charlottesville, Virginia* 22903 (AST76-23170)

Two areas of stellar structure will be considered in this work. The first will deal with the structure of highly evolved stars in other, nearby galaxies. The studies will be aimed at determining why the Draco dwarf spheroidal galaxy has a lower heavy element abundance than any globular cluster in our own galaxy. Model calculations will be made which attempt to fit the available observational data on stars in the system. The second aspect of this work will deal with models of the Sun. The difficulties that have occured in comparing theoretical predictions with observed neutrino fluxes are now well known. This work will investigate the influence of convection of the structure of the solar model.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0020, ELECTROCHEMISTRY OF MINERALS - NASA
M. SATO, U.S. Dept. of the Interior, Geological Survey, *Herndon, Virginia* 22092 (9710-01150)

The project is primarily responsible for determining the oxygen fugacity values of various lunar rocks and other planetary matter to provide basic data on the oxidation states of rocks and minerals in the solar system. On the basis of these data and other available information such as the behavior of volatile matters, we evaluate the causes and mechanisms of oxidation or reduction reactions operative in lunar and planetary formation and magmatism.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

GENERAL

11.0001, OPERATION OF AN INDUSTRIAL APPLICATIONS CENTER
UNKNOWN, Univ. of Connecticut, Graduate School, *Storrs, Connecticut* 06268 (NASW 3059)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N77-29058*+ National Aeronautics and Space Administration, Washington, D. C.
A CUMULATIVE INDEX TO THE 1976 ISSUES OF AERONAUTICAL ENGINEERING, A SPECIAL BIBLIOGRAPHY
Jan. 1977 514 p
(NASA-SP-7037(79)) Avail: NTIS HC E05 CSCL 01A

This cumulative index includes subject, personal author, corporate source, contract, and report number indexes to the abstracts contained in NASA SP-7037 (67) through NASA SP-7037 (78). Author

N77-29059*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COLLECTED WORKS OF CHARLES J. DONLAN
[1976] 772 p refs
(NASA-TM-74826) Avail: NTIS HC A99/MF A01 CSCL 02A

Spin tests and wind tunnel tests for various types of experimental aircraft are discussed. The fighter aircraft and monoplanes of the World War II era are emphasized. For individual titles, see N77-29060 through N77-29083.

N77-29060*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN APPROXIMATE SPIN DESIGN CRITERION FOR MONOPLANES, 1 MAY 1939 **c05**
Oscar Seidman and Charles J. Donlan *In its* Collected Works of Charles J. Donlan [1976] 11 p refs (For primary document see N77-29059 20-01)
(NACA-TN-711) Avail: NTIS HC A99/MF A01 CSCL 01C

An approximate empirical criterion, based on the projected side area and the mass distribution of the airplane, was formulated. The British results were analyzed and applied to American designs. A simpler design criterion, based solely on the type and the dimensions of the tail, was developed; it is useful in a rapid estimation of whether a new design is likely to comply with the minimum requirements for safety in spinning. Author

N77-29061*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SPIN TESTS OF A 1/20-SCALE MODEL OF THE XP-39 AIRPLANE, 15 MARCH 1939 **c05**
Charles J. Donlan *In its* Collected Works of Charles J. Donlan [1976] 23 p refs Sponsored in part by Army (For primary document see N77-29059 20-01)
Avail: NTIS HC A99/MF A01 CSCL 01C

The tests were performed to determine the spinning characteristics of a 1/20-scale model of the Bell XP-39 airplane. Effects of loading changes and of various control dispositions were studied. Subsequent tests were performed to determine the effect of a change in wing dihedral. Author

N77-29062*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SPIN TESTS OF A 1/20-SCALE MODEL OF THE XF4U-1 AIRPLANE, 12 JULY 1939 **c05**
Charles J. Donlan *In its* Collected Works of Charles J. Donlan [1976] 47 p refs Sponsored in part by Navy (For primary document see N77-29059 20-01)
Avail: NTIS HC A99/MF A01 CSCL 01C

These tests were performed to determine the spinning characteristics of the 1/20-scale model of the XF4U-1 airplane. Effects of loading changes and various control dispositions using both the original and modified vertical tail surfaces were studied. Subsequent tests were made to determine the effects of additional tail modifications. Author

N77-29063*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SPIN TESTS OF 1/16-SCALE MODELS OF THE N3N-3 LANDPLANE AND SEAPLANE, 12 JANUARY 1940 **c05**
Charles J. Donlan *In its* Collected Works of Charles J. Donlan [1976] 37 p refs Sponsored in part by Navy (For primary document see N77-29059 20-01)
Avail: NTIS HC A99/MF A01 CSCL 01C

The test program included the study of both the seaplane and landplane types. On both versions of the model, the effects of loading changes and control dispositions were examined, and on the seaplane, the effect of the cowled and uncowled engine was investigated. Author

N77-29064*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SPIN TESTS OF A LOW-WING MONOPLANE TO INVESTIGATE SCALE EFFECT IN THE MODEL TEST RANGE, MAY 1941 **c05**
Charles J. Donlan *In its* Collected Works of Charles J. Donlan [1976] 23 p refs (For primary document see N77-29059 20-01)
(NACA-TN-807) Avail: NTIS HC A99/MF A01 CSCL 01C

Concurrent tests were performed on a 1/16 and a 1/20 scale model (wing spans of 2.64 and 2.11 ft. respectively) of a modern low wing monoplane in the NACA 15 foot free-spinning wind tunnel. Results are presented in the form of charts that afford a direct comparison between the spins of the two models for a number of different conditions. Qualitatively, the same characteristic effects of control disposition, mass distribution, and dimensional modifications were indicated by both models. Quantitatively, the number of turns for recover and the steady spin parameters, with the exception of the inclination of the wing to the horizontal, were usually in good agreement. Author

N77-29065*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
METHODS OF ANALYZING WIND-TUNNEL DATA FOR DYNAMIC FLIGHT CONDITIONS **c02**
Charles J. Donlan and I. G. Recant *In its* Collected Works of Charles J. Donlan [1976] 43 p refs (For primary document see N77-29059 20-01)
(NACA-TN-828) Avail: NTIS HC A99/MF A01 CSCL 01A

The effects of power on the stability and the control characteristics of an airplane are discussed and methods of analysis

are given for evaluating certain dynamic characteristics of the airplane that are not directly discernible from wind tunnel tests alone. Data are presented to show how the characteristics of a model tested in a wind tunnel are affected by power. The response of an airplane to a rolling and a yawing disturbance is discussed, particularly in regard to changes in wing dihedral and fin area. Solutions of the lateral equations of motion are given in a form suitable for direct computations. An approximate formula is developed that permits the rapid estimation of the accelerations produced during pull-up maneuvers involving abrupt elevator deflections. Author

N77-29066*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE EFFECT OF COWLING SHAPE ON THE STABILITY CHARACTERISTICS OF AN AIRPLANE, SEPTEMBER 1942 **c08**
Charles J. Donlan and W. Letko *In its* Collected Works of Charles J. Donlan [1976] 21 p refs (For primary document see N77-29059 20-01)
(L-343) Avail: NTIS HC A99/MF A01 CSCL 01C

Three widely different nose shapes were tested on a fuselage alone and on a complete model in the NACA stability tunnel to investigate the effect of cowling shape on stability characteristics. The results are presented in the form of charts which show the variation in the aerodynamic characteristics with the three nose shapes for the propeller-removed condition over a wide range of angles of attack and yaw. The results indicated that large changes in the cowling shape produced relatively small changes in the aerodynamic characteristics. The effects may be appreciable, however, in the case of an airplane that has marginal stability. Author

N77-29067*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SOME THEORETICAL CONSIDERATIONS OF LONGITUDINAL STABILITY IN POWER-ON FLIGHT WITH SPECIAL REFERENCE TO WIND-TUNNEL TESTING, NOVEMBER 1942 **c08**
Charles J. Donlan *In its* Collected Works of Charles J. Donlan [1976] 25 p refs (For primary document see N77-29059 20-01)
(L-309) Avail: NTIS HC A99/MF A01 CSCL 01C

Some problems relating to longitudinal stability in power-on flight are considered. A derivation is included which shows that, under certain conditions, the rate of change of the pitching moment coefficient with lift coefficient as obtained in wind tunnel tests simulating constant power operation is directly proportional to one of the indices of stability commonly associated with flight analysis, (the slope of the curve relating the elevator angle for trim and lift coefficient). The necessity of analyzing power-on wind tunnel data for trim conditions is emphasized, and a method is provided for converting data obtained from constant thrust tests to simulated constant throttle flight conditions. Author

N77-29068*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LATERAL STABILITY AND CONTROL TESTS OF THE XP-77 AIRPLANE IN THE NACA FULL-SCALE TUNNEL, 16 JUNE 1944 **c05**
K. R. Czarnecki and Charles J. Donlan *In its* Collected Works of Charles J. Donlan [1976] 84 p refs Sponsored in part by Army (For primary document see N77-29059 20-01)
Avail: NTIS HC A99/MF A01 CSCL 01C

Tests were made in the NACA full-scale tunnel to determine the lateral stability and control characteristics of the XP-77 airplane. Measurements were made of the forces and moments on the airplane at various angles of attack and angles of yaw. The measurements were made with the propeller removed and with the propeller installed and operating at various thrust coefficients, and with the landing flaps retracted and deflected. The effects of aileron, elevator, and rudder deflection on control surface effectiveness and hinge moments were determined. The tests were planned to obtain the data required to evaluate as completely as possible the Army Air Force requirements on lateral stability and control for pursuit-type airplanes. Author

N77-29069*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE LATERAL FLYING QUALITIES OF THE BELL XP-77 AIRPLANE AS ESTIMATED FROM FULL-SCALE TUNNEL TESTS, 16 JUNE 1944 **c02**
Charles J. Donlan and K. R. Czarnecki *In its* Collected Works of Charles J. Donlan [1976] 23 p refs Sponsored in part by Army (For primary document see N77-29059 20-01)
Avail: NTIS HC A99/MF A01 CSCL 01A

Results are presented for tests made of the full scale model of the airplane in the NACA full scale tunnel. These tests were planned so as to cover as completely as possible the lateral flying quality requirements for pursuit-type airplanes contracted for by the United States Army Air Forces. Author

N77-29070*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE STABILITY AND CONTROL OF TAILLESS AIRPLANES, 19 AUGUST 1944 Interim Report **c08**
Charles J. Donlan, comp. *In its* Collected Works of Charles J. Donlan [1976] 16 p refs (For primary document see N77-29059 20-01)
(Rept-796) Avail: NTIS HC A99/MF A01 CSCL 01C

In the present state of the design of tailless airplanes, it appears that: (1) Sweepback affords a method of supplying tail length for directional and longitudinal stability and control and allows the utilization of a high-lift flap but introduces undersirable tip stalling tendencies that must be overcome before the advantages of sweepback can be realized. (2) The damping in pitching appears to have little effect on the longitudinal behavior of the airplane provided the static margin is never permitted to become negative. (3) The directional stability must be as great as for conventional airplanes if the same requirements regarding satisfactory stability and control characteristics are to be adhered to. (4) The influence of the lateral resistance and the damping in yawing on the flying qualities is somewhat obscure. Author

N77-29071*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
WIND-TUNNEL TESTS OF A 1/4 SCALE MODEL OF THE BELL XS-1 TRANSONIC AIRPLANE. 1: LONGITUDINAL STABILITY AND CONTROL CHARACTERISTICS **c02**
Charles J. Donlan, W. B. Kemp, and E. C. Polhamus *In its* Collected Works of Charles J. Donlan [1976] 78 p refs (For primary document see N77-29059 20-01)
(DA Proj. 653)
(L6D12) Avail: NTIS HC A99/MF A01 CSCL 01A

A 1/4 scale model of the Bell XS-1 transonic aircraft was tested in the Langley 300 mile-per-hour 7 by 10 foot tunnel to determine its low speed longitudinal stability and control characteristics. Pertinent longitudinal flying qualities expected of the XS-1 research airplane were estimated from the results of these tests including the effects of compressibility likely to be encountered at speeds below the force break. It appears that the static longitudinal stability and elevator control power will be adequate, but that the elevator control force gradient in steady flight will be undesirably low for all configurations. It is suggested that a centering spring be incorporated in the elevator control system of the airplane in order to increase the control force gradient in steady flight and in maneuvers. Author

N77-29072*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CURRENT STATUS OF LONGITUDINAL STABILITY, 24 MAY 1948 **c08**
Charles J. Donlan *In its* Collected Works of Charles J. Donlan [1976] 17 p refs (For primary document see N77-29059 20-01)
(L8A28) Avail: NTIS HC A99/MF A01 CSCL 01C

The problems of static and dynamic longitudinal stability both at high speeds and at low speeds are discussed and data are presented which indicate progress made in the solution of these problems. It is shown that the incorporation of large amounts of sweepback on both the wing and the horizontal tail can significantly increase the Mach number at which critical trim changes and stability changes occur and can greatly reduce the trim changes and stability changes encountered at supercritical speeds. Data are also presented which demonstrate the

possibility of obtaining satisfactory longitudinal stability in the landing configuration for wings with sweepback of the order of 45 deg utilizing various stall control devices. Optimum arrangements for such devices, however, should be determined experimentally. Author

N77-29073*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FACTORS AFFECTING STATIC LONGITUDINAL STABILITY AND CONTROL c08
Charles J. Donlan *In its* Collected Works of Charles J. Donlan [1976] 16 p refs (For primary document see N77-29059 20-01)
Avail: NTIS HC A99/MF A01 CSCL 01C

The various factors that constitute static longitudinal stability and control are reviewed and the influence on these factors of power effects and Mach number effects are indicated. Author

N77-29074*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LOW-SPEED WIND-TUNNEL INVESTIGATION OF THE LONGITUDINAL STABILITY CHARACTERISTICS OF A MODEL EQUIPPED WITH A VARIABLE-SPEED WING, 23 MAY 1949 c02
Charles J. Donlan and William C. Sleeman, Jr. *In its* Collected Works of Charles J. Donlan [1976] 43 p refs (For primary document see N77-29059 20-01)
(L9B18) Avail: NTIS HC A99/MF A01 CSCL 01A

The longitudinal stability characteristics of a complete model equipped with a variable sweep wings at angles of sweepback of 45 deg, 30 deg, 15 deg, and 0 deg investigated. Various wing modifications and an extern 1 flap arrangement designed to minimize the shift in neutral point accompanying the change in sweep angle were studied. The results indicate that stability at the stall was obtained at a sweep angle of 15 deg without recourse to stall control devices. The basic neutral point movement accompanying the change in sweep angle from 45 deg to 15 deg amounted to 56 percent of the mean aerodynamic chord (at zero sweep angle) and the most effective modification investigated only reduced this change to 47 percent of the chord. It appears, therefore, that for designs in which the fuselage is the major load carrying element some relative movement between the wing and center of gravity will be required to assure satisfactory stability at all sweep angles. Author

N77-29075*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ESTIMATED TRANSONIC FLYING QUALITIES OF A TAILLESS AIRPLANE BASED ON A MODEL INVESTIGATION, 8 JUNE 1949 c02
Charles J. Donlan and Richard E. Kuhn *In its* Collected Works of Charles J. Donlan [1976] 62 p refs (For primary document see N77-29059 20-01)
(L9D08) Avail: NTIS HC A99/MF A01 CSCL 01A

Flying qualities of a tailless airplane with the wing quarter chord line swept back 35 deg were analyzed in the Mach number range from 0.40 to 0.91 based on tests of a model of this airplane in the Langley high speed 7 by 10 foot tunnel. The results indicate that longitudinal control position instability exists at transonic speeds but the accompanying trim changes are not large. Control position maneuvering stability, however, is present for all speeds. Longitudinal and lateral control appear adequate, but the damping of the short period longitudinal and lateral oscillations at high altitudes is poor and would probably require artificial damping. Author

N77-29076*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SOME EFFECTS OF SWEEPBACK AND AIRFOIL THICKNESS ON LONGITUDINAL STABILITY AND CONTROL CHARACTERISTICS AT TRANSONIC SPEEDS c08
Charles J. Donlan and Arva A. Luoma *In its* Collected Works of Charles J. Donlan [1976] 12 p refs (For primary document see N77-29059 20-01)
Avail: NTIS HC A99/MF A01 CSCL 01C

Information on the longitudinal stability and control characteristics of complete transonic airplane configurations is compiled in a form that might indicate whether or not a consistent pattern of behavior exists in regard to the effects of airfoil thickness and sweepback on overall stability and control characteristics at transonic speeds. Author

N77-29077*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A COMPARISON OF THE AERODYNAMIC CHARACTERISTICS AT TRANSONIC SPEEDS OF FOUR WING-FUSELAGE CONFIGURATIONS AS DETERMINED FROM DIFFERENT TEST TECHNIQUES, 4 OCTOBER 1960 c02
Charles J. Donlan, Boyd C. Myers, II, and Axel T. Mattson *In its* Collected Works of Charles J. Donlan [1976] 65 p refs (For primary document see N77-29059 20-01)
(L50H02) Avail: NTIS HC A99/MF A01 CSCL 01A

The high speed aerodynamic characteristics of a family of four wing-fuselage configurations of 0, 35, 45, and 60 deg sweepback were determined from transonic bump model tests that were conducted in the Langley high speed 7 by 10 foot tunnel; sting supported model tests were conducted in the Langley 8 foot high speed tunnel and in the Langley high speed 7 by 10 foot tunnel, and rocket model tests were conducted by the Langley Pilotless Aircraft Research Division. A complementary study of the effect of Mach number gradients and streamline curvature on bump results is also included. The qualitative data obtained from the various test facilities for the wing-fuselage configurations were in essential agreement as regards the relative effects of sweepback and Mach number except for drag at zero lift. Quantitatively, important differences were present. Author

N77-29078*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CHARACTERISTICS OF SWEPT WINGS AT HIGH SPEEDS, 30 JANUARY 1952 c05
Charles J. Donlan and Joseph Weil *In its* Collected Works of Charles J. Donlan [1976] 20 p refs (For primary document see N77-29059 20-01)
(L52A15) Avail: NTIS HC A99/MF A01 CSCL 01C

Some results of recent swept wing investigations are presented, that were undertaken to determine the effects of thickness and thickness distribution, camber and twist, nose-flap deflection, and devices or fixes for improving the wing pitching moment characteristics at high lift coefficients. Author

N77-29079*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN ASSESSMENT OF THE AIRPLANE DRAG PROBLEM AT TRANSONIC AND SUPERSONIC SPEEDS, 15 JULY 1974 c02
Charles J. Donlan *In its* Collected Works of Charles J. Donlan [1976] 16 p refs Presented at Meeting of NACA Comm. on Aerodyn., Langley Station, Va., 28 Apr. 1954 (For primary document see N77-29059 20-01)
(L54F16) Avail: NTIS HC A99/MF A01 CSCL 01A

The factors influencing the drag of bodies of revolution are reviewed, and the effectiveness in reducing wave drag of various methods of improving the cross sectional area distribution of aircraft configurations is illustrated. It is demonstrated that, irrespective of the method adopted for improving area distribution, a high effective fineness ratio and smooth area progressions along the equivalent body are essential to the achievement of low drag. Author

N77-29080*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PROJECT MERCURY: THE PROGRAM AND ITS OBJECTIVES c12
Charles J. Donlan and Jack C. Heberlig *In its* Collected Works of Charles J. Donlan [1976] 26 p refs Presented at Symp. on Psychophysiolog. Aspects of Space Flight, San Antonio, Tex., 26-27 May 1960 (For primary document see N77-29059 20-01)
Avail: NTIS HC A99/MF A01 CSCL 22A

Project Mercury is reviewed in the light of experience gained thus far in the technical implementation of this Nation's initial program for manned orbital flight. Initial guidelines formulated for the Mercury program are reviewed, together with some of the technical considerations that have influenced the design of the capsule and the operational plan for the booster-capsule vehicle. The role of the astronaut in the Mercury program is

discussed, and some observations are made concerning the impact of the Mercury program on future manned space ventures.
Author

N77-29081*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
GUIDELINES FOR ADVANCED MANNED SPACE VEHICLE PROGRAM, JUNE 1960 **c12**
Robert R. Gilruth, Robert O. Piland, Mayime A. Faget, Stanley C. White, Robert C. Chilton, and Charles J. Donlan *In its* Collected Works of Charles J. Donlan [1976] 66 p refs (For primary document see N77-29059 20-01)
Avail: NTIS HC A99/MF A01 CSCL 22A

A very broad mission objective was established; i.e., manned circumlunar flight and return to earth. It is implicit that the Saturn will be the primary propulsion system for this mission. The following attempts to: (1) define the objective so as to achieve as much capability in the vehicle as possible; (2) draw on Mercury experience to provide broad guidelines for vehicle performance and safety; (3) provide flexibility in the vehicle capability in the event that the manned lunar mission is proved to be subject to unacceptable risk in the target time period; and (4) indicate problem areas where work appears to be particularly needed.
Author

N77-29082*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PROPORTIONING THE AIRPLANE FOR LATERAL STABILITY **c05**
Charles J. Donlan *In its* Collected Works of Charles J. Donlan [1976] 6 p refs (For primary document see N77-29059 20-01)
Avail: NTIS HC A99/MF A01 CSCL 01C

Proportioning for lateral aircraft control included: (1) directional stability (slope of curve of yawing moment coefficient against sideslip), and (2) effective dihedral factor (slope of curve of rolling moment coefficient against sideslip). Basic forces influencing the directional stability of aircraft are indicated. Propeller side force, basic fuselage yaw, and vertical tail side force contributed to yaw moment about center of gravity. J.A.M.

N77-29083*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PROGRESS REPORT ON PROJECT MERCURY **c12**
Charles J. Donlan and Jack C. Heberlig *In its* Collected Works of Charles J. Donlan [1976] 6 p Repr. from Astronautics, Aug. 1960 p 32-33, 73-76 (For primary document see N77-29059 20-01)
Avail: NTIS HC A99/MF A01 CSCL 22A

Progress on Project Mercury, program for manned orbital space flight, is briefly reviewed. The original aims and concepts of the project are recounted. Various types of launch apparatus are mentioned along with safety factors.
J.A.M.

N77-29084*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STABILITY AND CONTROL CHARACTERISTICS OF A MONOPLANNAR MISSILE CONFIGURATION WITH TWO LOW-PROFILE TAIL ARRANGEMENTS AT MACH NUMBERS FROM 1.70 TO 2.86
A. B. Blair, Jr. Washington Aug. 1977 97 p refs
(NASA-TM-X-3533; L-11459) Avail: NTIS HC A05/MF A01 CSCL 02A

An experimental wind tunnel investigation has been made to determine the longitudinal and lateral aerodynamic stability and control characteristics of two tail fin arrangements of a monowing missile model. Both a conventional cruciform and a low profile tail arrangement were tested. The results indicate that the tail surfaces of both configurations were effective in producing pitch control. It was also concluded that both are effective in producing roll and yaw control that is accompanied by proverse yaw and roll, respectively. The conventional cruciform tail produces the most roll and yaw control.
Author

N77-29085*# Aerophysics Research Corp., Bellevue, Wash.
NSEG, A SEGMENTED MISSION ANALYSIS PROGRAM FOR LOW AND HIGH SPEED AIRCRAFT. VOLUME 1: THEORETICAL DEVELOPMENT Final Report
D. S. Hague and H. L. Rozendaal Washington NASA Aug. 1977 82 p refs 3 Vol.
(Contract NAS1-13599)
(NASA-CR-2807) Avail: NTIS HC A05/MF A01 CSCL 02A

A rapid mission analysis code based on the use of approximate flight path equations of motion is presented. Equation form varies with the segment type, for example, accelerations, climbs, cruises, descents, and decelerations. Realistic and detailed characteristics were specified in tabular form. The code also contains extensive flight envelope performance mapping capabilities. Approximate take off and landing analyses were performed. At high speeds, centrifugal lift effects were accounted for. Extensive turbojet and ramjet engine scaling procedures were incorporated in the code.
Author

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

N77-29086 California Univ., Los Angeles.
A STUDY OF THE EFFECT OF UNSTEADY AERODYNAMICS ON THE AEROELASTIC STABILITY OF ROTOR BLADES IN HOVER Ph.D. Thesis
Cheng-Hsien Yuan 1976 166 p
Avail: Univ. Microfilms Order No. 77-8539

Various existing unsteady aerodynamic strip theories which have been developed in the past for both fixed and rotary wing aerodynamic analyses are modified so as to make them applicable to the coupled flap-lag-torsional aeroelastic problem of a rotor blade in hover. The modified strip theories are incorporated in a coupled flap-lag-torsional aeroelastic analysis. The results indicate that the various unsteady aerodynamic strip theories available must be modified and reinterpreted when applying them to the coupled flap-lag-torsional aeroelastic problem of a rotor blade in hover. These modifications are primarily due to constant angle of attack, constant inflow, and variable free stream velocity due to lead-lag motion.
Dissert. Abstr.

N77-29087 Minnesota Univ., Minneapolis.
DYNAMICS AND STABILITY OF LIFTING PARACHUTES Ph.D. Thesis
David Paul Saari 1976 209 p
Avail: Univ. Microfilms Order No. 77-6999

A dynamic model is formulated which is capable of describing the three-dimensional motion of a general parachute-load system with general initial conditions, and a method is presented for determining five components of aerodynamic force and moment as functions of general angles of attack in three-dimensional motion. Wind tunnel measurements of the aerodynamic coefficients for a lifting parachute made at a Reynolds number of 5.500,00 is presented.
Dissert. Abstr.

N77-29088 Cincinnati Univ., Ohio.
VISCOUS SHOCK LAYER SOLUTIONS FOR HYPERSONIC SPHERE-CONES Ph.D. Thesis
Basuki Nath Srivastava 1977 199 p
Avail: Univ. Microfilms Order No. 77-6692

An analysis and numerical solution of the fully viscous shock layer equations for hypersonic flow past spherically blunted cones is presented. Attention is drawn to the adverse effect in the numerical solution due to discontinuities in the flow derivatives caused by the discontinuity in the surface curvature at the sphere/cone tangency point, when the usual surface coordinate frame of reference is used. It is shown that a finite difference formulation that accounts for the embedded gradient discontinuities resolves these numerical difficulties. This concept is demonstrated through a numerical scheme which utilizes a time dependent relaxation technique for the bow shock shape. A model problem analogous to the sphere/cone juncture problem is first formulated and finite difference schemes are developed and demonstrated for this case.
Dissert. Abstr.

N77-29089 California Univ., Los Angeles.
THE COUPLED FLAP-LAG-TORSIONAL AEROELASTIC STABILITY OF HELICOPTER ROTOR BLADES IN FORWARD FLIGHT Ph.D. Thesis
Manuel Reyna-Allende 1976 295 p
Avail: Univ. Microfilms Order No. 77-8530

A set of coupled flap lag torsional equations of motion capable of simulating general hingeless rotor blade configurations are derived for the case of a rotor blade having moderate deflections. The final equations of motion are represented by a system of coupled, nonlinear partial differential equations. The equations are capable of simulating rotor blades having: (1) precone; (2) droop; (3) built in twist; (4) distributed torsion; (5) root torsion (or pitch link flexibility); (6) blade root offsets; (7) and offsets between the elastic axis, aerodynamic center and the blade cross sectional center of mass. Quasisteady aerodynamic loads are used and the effects of stall and compressibility are neglected. Reversed flow is included in the representation of the airloads.
Dissert. Abstr.

N77-29090 Georgia Inst. of Tech., Atlanta.
A METHOD OF COMPUTING THE POTENTIAL FLOW ON THICK WING TIPS Ph.D. Thesis
Pradeep Rao 1976 174 p
Avail: Univ. Microfilms Order No. 77-7352

An iterative procedure to compute detailed velocity and pressure distributions on the surface of thick wing tips is developed using potential flow theory. The method uses a two dimensional surface vorticity distribution as an initial approximation. Therefore, the two dimensional problem is first formulated in the form of an integral equation using vorticity as the surface singularity which is solved by the elementary vortex distribution technique. A comparison of the flow computed on a circular cylinder with the exact analytical results provides a measure of accuracy. The two dimensional noncirculatory and circulatory flow is computed for NACA basic thickness form airfoils. Dissert. Abstr.

N77-29091 Cornell Univ., Ithaca, N.Y.
TWO PROBLEMS THAT ARISE IN THE GENERATION AND PROPAGATION OF SONIC BOOMS. 1: FLOW FIELD IN THE PLANE OF SYMMETRY BELOW A DELTA WING. 2: FOCUSING OF AN ACOUSTIC PULSE AT AN ARETE Ph.D. Thesis
Mark Stephen Cramer 1976 42 p
Avail: Univ. Microfilms Order No. 77-8353

The flow field in the plane of symmetry of a thin, lifting delta wing with supersonic leading edges is examined. A simplified treatment of the interaction between the plane expansion wave enamating from the trailing edge and the three-dimensional bow shock is presented. In the region unaffected by the wing tips, the shock decays inversely with distance from the wing. The focusing of a nearly straight acoustic wavefront is examined. The equation that describes this focusing is derived and the resulting similitude discussed. The initial conditions come from a formal matching of this nonlinear description with the linear solution. The maximum value of the pressure coefficient is shown to be proportional to the two-thirds power of both the initial strength of the wavefront and a small parameter characterizing its straightness. Dissert. Abstr.

N77-29092 Princeton Univ., N. J.
UNSTEADY LIFTING SURFACE THEORY IN AN INCOMPRESSIBLE SHEAR FLOW Ph.D. Thesis
Mien Ray Chi 1977 201 p
Avail: Univ. Microfilms Order No. 77-7357

A shear flow unsteady lifting surface theory for incompressible flows is presented. The shear flow model which assumes a rotational inviscid shear flow within a finite distance from vertical to the plane of a thin wing and an irrotational potential flow elsewhere is employed to approximate the viscous boundary layer present on a flat plate when exposed to an external viscous flow. Both unsteady (constant shear layer thickness) and steady (both constant and variable shear layer thicknesses) aerodynamic forces are computed for flat plate airfoil motions in shear flows. The calculated aerodynamic forces are decreased by the shear layer, compared to the potential flow, while the variable thickness shear layer (steady case) decreases it less than the constant thickness shear layer based upon equal maximum shear layer thicknesses. Dissert. Abstr.

N77-29093 California Inst. of Tech., Pasadena.
STUDIES IN VORTEX MOTION Ph.D. Thesis
Gregory Richard Baker 1977 194 p
Avail: Univ. Microfilms Order No. 77-7387

Free streamline theory is used to determine the steady solutions of an array of identical, hollow or stagnant core vortices in an inviscid, incompressible fluid. Stability analysis shows that the more deformed shape is unstable to infinitesimal symmetric disturbances which leave the centers of the vortices undisplaced. The roll up of vortex sheets in homogeneous fluid is examined. Despite modifications which improve the accuracy of the method, unphysical results occur which show small scale growth and amalgamation into larger structures. The motion of a buoyant pair of line vortices of opposite circulation is considered. A macroscopic model is developed which shows the formation of a detrainment filament and is included as a modification to the model. Dissert. Abstr.

N77-29094 California Inst. of Tech., Pasadena.
FINITE AMPLITUDE UNSTEADY SLENDER BODY THEORY AND EXPERIMENTS Ph.D. Thesis
George Thomas Yates 1977 136 p
Avail: Univ. Microfilms Order No. 77-7398

Several theoretical models are discussed and new developments are directed toward a finite amplitude theory where flow singularities are distributed along the body centerline, which may undergo arbitrary body motion and where the body cross section is presently restricted to being circular. Guided by the example of a toroidal ring, for which simple symmetry in shape makes a highly accurate solution possible, the general theory is developed and results are given for the force and rate of work done by the fluid on the moving body. An example with application to the anguilliform mode of aquatic animal propulsion is given and compared to observations on a swimming eel. A truly three-dimensional body (modeled after a Chinook salmon) was used to examine the basic slender body assumptions. Pressure measurements were made on the model surface using a set of high sensitivity pressure transducers, and several theoretical solutions are evaluated and compared with the measured pressure distribution. Dissert. Abstr.

N77-29095*# Rockwell International Corp., Los Angeles, Calif. Aircraft Div.
LOW SPEED AERODYNAMIC CHARACTERISTICS OF A VECTORED THRUST V/STOL TRANSPORT WITH TWO LIFT/CRUISE FANS
Dirk J. Renselaer Jul. 1977 201 p refs
(Contract NAS2-9003)
(NASA-CR-152029) Avail: NTIS HC A10/MF A01 CSCL 01A

A wind tunnel test was conducted to obtain power on low speed characteristics of a twin fan vectored thrust V/STOL transport aircraft. Longitudinal, as well as some lateral directional data, were analyzed. Hover, STOL, and conventional flight modes were investigated. Determination of STOL characteristics, hover characteristics, roll control effectiveness and aircraft attitude were evaluated. The study also included various means to improve the lifting capability of the aircraft such as by application of fuselage strakes, exhaust vanes capable of shifting the thrust vector aft, and external flap blowing for STOL performance.
Author

N77-29096*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LOW-SPEED WIND TUNNEL INVESTIGATION OF AN ADVANCED SUPERSONIC CRUISE ARROW-WING CONFIGURATION
Paul L. Coe, Jr., Paul M. Smith (Vought Corp., Hampton, Va.), and Lysle P. Parlett Jul. 1977 85 p refs
(NASA-TM-74043) Avail: NTIS HC A05/MF A01 CSCL 01A

A preliminary assessment of possible means for improving the low speed aerodynamic characteristics of advanced supersonic cruise arrow wing configurations and to extend the existing data base of such configurations has been made. Principle configuration variables included wing-leading and trailing-edge flap deflection,

fuselage nose strakes, and engine exhaust nozzle deflection. Results showed that deflecting the wing leading edge apex flaps downward provided improved longitudinal stability but resulted in reduced directional stability. The model exhibited relatively low values of directional stability over the operational angle of attack range and experienced large asymmetric yawing moments at high angles of attack. The use of nose strakes was found to be effective in increasing the directional stability and eliminating the asymmetric yawing moment. Author

N77-29097*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LOAD DISTRIBUTION ON A CLOSED-COUPLED WING CANARD AT TRANSONIC SPEEDS
Blair B. Gloss and Karen E. Washburn Aug. 1977 11 p refs
(NASA-TM-74053) Avail: NTIS HC A02/MF A01 CSCL 01A

A wind tunnel test where load distributions were obtained at transonic speeds on both the canard and wing surfaces of a closely coupled wing canard configuration is reported. Detailed component and configuration arrangement studies to provide insight into the various aerodynamic interference effects for the leading edge vortex flow conditions encountered are included. Data indicate that increasing the Mach number from 0.70 to 0.95 caused the wing leading edge vortex to burst over the wing when the wing was in the presence of the high canard. Author

N77-29098*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
F-8 SUPERCRITICAL WING FLIGHT PRESSURE, BOUNDARY LAYER, AND WAKE MEASUREMENTS AND COMPARISONS WITH WIND TUNNEL DATA
Lawrence C. Montoya and Richard D. Banner Washington Jun. 1977 194 p refs
(NASA-TM-X-3544; H-850) Avail: NTIS HC A09/MF A01 CSCL 01A

Data for speeds from Mach 0.50 to Mach 0.99 are presented for configurations with and without fuselage area-rule additions, with and without leading-edge vortex generators, and with and without boundary-layer trips on the wing. The wing pressure coefficients are tabulated. Comparisons between the airplane and model data show that higher second velocity peaks occurred on the airplane wing than on the model wing. The differences were attributed to wind tunnel wall interference effects that caused too much rear camber to be designed into the wing. Optimum flow conditions on the outboard wing section occurred at Mach 0.98 at an angle of attack near 4 deg. The measured differences in section drag with and without boundary-layer trips on the wing suggested that a region of laminar flow existed on the outboard wing without trips. Author

N77-29099*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
REVISED FORTRAN PROGRAM FOR CALCULATING VELOCITIES AND STREAMLINES ON THE HUB-SHROUD MIDCHANNEL STREAM SURFACE OF AN AXIAL-, RADIAL-, OR MIXED-FLOW TURBOMACHINE OR ANNULAR DUCT. 2: PROGRAMMER'S MANUAL
Theodore Katsanis and William D. McNally Washington Jul. 1977 232 p refs Revised
(NASA-TN-D-8431; E-8969) Avail: NTIS HC A11/MF A01 CSCL 01A

A FORTRAN IV computer program has been developed that obtains a detailed subsonic or shock free transonic flow solution on the hub-shroud midchannel stream surface of a turbomachine. The blade row may be fixed or rotating, and the blades may be twisted and leaned. Flow may be axial, mixed, or radial. Upstream and downstream flow variables may vary from hub to shroud, and provisions are made to correct for loss of stagnation pressure. The results include velocities, streamlines, and flow angles on the stream surface and approximate blade surface velocities. Author

N77-29100*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MEASUREMENTS OF SURFACE-PRESSURE AND WAKE-FLOW FLUCTUATIONS IN THE FLOW FIELD OF A WHITCOMB SUPERCRITICAL AIRFOIL
Frederick W. Roos (McDonnell Douglas Corp., St. Louis, Mo.) and Dennis W. Riddle Washington Aug. 1977 53 p refs
(NASA-TN-D-8443; A-6877) Avail: NTIS HC A04/MF A01 CSCL 01A

Measurements of surface pressure and wake flow fluctuations were made as part of a transonic wind tunnel investigation into the nature of a supercritical airfoil flow field. Emphasis was on a range of high subsonic Mach numbers and moderate lift coefficients corresponding to the development of drag divergence and buffeting. Fluctuation data were analyzed statistically for intensity, frequency content, and spatial coherence. Variations in these parameters were correlated with changes in the mean airfoil flow field. Author

N77-29101*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECT OF WINGLETS ON A FIRST-GENERATION JET TRANSPORT WING. 2: PRESSURE AND SPANWISE LOAD DISTRIBUTIONS FOR A SEMI SPAN MODEL AT HIGH SUBSONIC SPEEDS
Lawrence C. Montoya (NASA Dryden Flight Research Center), Stuart G. Flechner, and Peter F. Jacobs Washington Jul. 1977 211 p refs
(NASA-TN-D-8474; L-11026) Avail: NTIS HC A10/MF A01 CSCL 01A

Pressure and spanwise load distribution on a first generation jet transport semispan model at high subsonic speeds are presented. The data were given for the basic wing and for configurations with an upper winglet only, upper and lower winglets, and a simple wing tip extension. Selected data were discussed to show the general trends and effects of the various configurations. Author

N77-29102*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SUBSONIC AND SUPERSONIC AERODYNAMIC CHARACTERISTICS OF A SUPERSONIC CRUISE FIGHTER MODEL WITH A TWISTED AND CAMBERED WING WITH 74 DEG SWEEP
Odell A. Morris Washington Aug. 1977 63 p refs
(NASA-TM-X-3530; L-11457) Avail: NTIS HC A04/MF A01 CSCL 01A

A wind tunnel investigation has been conducted to determine the longitudinal and lateral aerodynamic characteristics of a model of a supersonic cruise fighter configuration with a design Mach number of 2.60. The configuration is characterized by a highly swept arrow wing twisted and cambered to minimize supersonic drag due to lift, twin wing mounted vertical tails, and an aft mounted integral underslung duel-engine pod. The investigation also included tests of the configuration with larger outboard vertical tails and with small nose strakes. Author

N77-29103# Air Force Geophysics Lab., Hanscom AFB, Mass.
PROCEEDINGS, 9TH AFGL SCIENTIFIC BALLOON SYMPOSIUM Scientific Biennial Report
George F. Nolan, ed. 12 Dec. 1976 547 p refs Conf. proc. held at Portsmouth, N.H., 20-22 Oct. 1976
(AF Proj. 6665)
(AD-A040489; AFGL-TR-76-0306; AFGL-SR-200) Avail: NTIS HC A23/MF A01 CSCL 01/3

This publication contains papers presented at the Ninth AFGL Scientific Balloon Symposium, 20 October to 22 October 1976, held at Wentworth By-The-Sea, Portsmouth, New Hampshire. Author (GRA)

N77-29104# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Luftstrahlantriebe.
CALCULATION OF THREE-DIMENSIONAL CASCADE FLOW BY MEANS OF A FIRST ORDER PANEL METHOD
Juergen Renken 3 Dec. 1976 24 p refs Presented at the Euromech Colloq. 75 on Calculation of Flow Fields by Means of Panel Methods, Brunswick, 10-13 May 1976
(DLR-FB-76-64) Avail: NTIS HC A02/MF A01; DFVLR, Cologne DM 12.80

A first order panel method for the calculation of three-dimensional, incompressible potential flow in a straight cascade having contractable sidewalls, was developed in order to

investigate the influence of contracted sidewalls on the flow through a straight compressor cascade. The structure is explained in principle. Results of the method are presented and compared with results obtained by classical two-dimensional and quasi-three-dimensional methods for the case of a compressor cascade with 48 deg cambered double-circular-arc blades. Author (ESA)

N77-29105# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.

PREDICTION OF AERODYNAMIC INTERFERENCE EFFECTS ON A FIGHTER TYPE WING-TIP TANK CONFIGURATION WITH AND WITHOUT PYLON AND STORE

H. A. Sytsma 5 Mar. 1975 36 p refs
(Contract RNLAF-RB-KL-1975/S3)
(NLR-TR-75070-U) Avail: NTIS HC A03/MF A01

Using the NLR panel method, pressure distribution was calculated for a fighter type wing-tiptank configuration with and without pylon and store to establish the applicability of this panel mwthod to the aerodynamic interference problems associated with this type of configurations. Calculated pressure distributions on wing and store are compared with experimental results. Agreement between theoretical and experimental results is satisfactory. Author (ESA)

N77-29106# Southampton Univ. (England). Theoretical Aerodynamics Unit.

THE NUMERICAL CALCULATION OF STEADY INVISCID SUPERCRITICAL FLOW PAST ELLIPSOIDS WITHOUT CIRCULATION

P. W. Duck London Aeron. Res. Council 1977 48 p refs Supersedes RAE-TR-75087; ARC-36304 Sponsored by Sci. Res. Council
(ARC-R/M-3794; RAE-TR-75087; ARC-36304) Avail: NTIS HC A03/MF A01; HMSO £5; PHI $19.35

Numerical solutions are obtained for supercritical flow around ellipsoids without circulation and under steady, inviscid conditions. Using an ellipsoidal coordinate system, the body-surface boundary-condition is then applied exactly (in the numerical sense). By means of a transformation of one of the coordinates, the infinite flow field is brought into a finite space for the calculation. The complete continuity equation is approximated by the usual central differencing in the elliptic (subcritical) regions, whilst in the hyperbolic (supercritical) regions, the combination of central and non-central differencing as suggested by Albone and Jameson is used, in order to model the absence of upstream propagation of disturbances. Although shock waves appear in the calculations, their shape and position is only approximately determined since the difference scheme only ensures continuity of the potential across the shock, the Rankine-Hugoniot equations not being satisfied. A number of results is presented, for flows aligned along the major and second axes, and also yawed relative to these two axes. Author (ESA)

N77-29107# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).

THE ORIGIN OF SELF-EXCITED OSCILLATIONS OF A HYPERSONIC FLOW IN A DUCT WITH SUDDEN ENLARGEMENT OF CROSS SECTION [UEBER DIE ENTSTEHUNG SELBSTERREGTER SCHWINGUNGEN EINER UEBERSCHALL-STROEMUNG IN EINEM KANAL MIT PLOETZLICHER QUERSCHNITTSERWEITERUNG]

Georg Grabitz Nov. 1976 32 p refs In GERMAN
(MPIS-14/1976) Avail: NTIS HC A03/MF A01; Max-Planck-Inst. fuer Stroemungsforsch., Goettingen, West Ger. DM 7.50

The mechanism of self excitation in a hypersonic ducted flow with stepwise enlargement of the cross section was investigated. The hypersonic expansion area was idealized and described by gas dynamic equations with an integral method. Three different model equations were used to link the flow area behind the perpendicular shock with the dead water. Two of the models appear to provide properties similar to those of the experimentally observed mechanism correctly. ESA

N77-29108# European Space Agency, Paris (France).

BEHAVIOR OF A SUBSONIC FLOW PAST A THIN WING IN THE VICINITY OF THE LEADING EDGE

Jean-Sylvestre Darrozes Jul. 1977 48 p refs Transl. into ENGLISH of 'Comportement d'un Ecoulement Subsonique au Voisinage du Bord d'Attaque d'une Aile Mince', ONERA, Paris Report ONERA-NT-1976-16, Feb. 1977 Original report in FRENCH previously announced as N77-25107
(ESA-TT-401; ONERA-NT-1976-16) Avail: NTIS HC A03/MF A01

The technique of matched asymptotic expansions leads to a uniformly valid description of a subsonic flow past a thin wing with round edges. The outer solution is the classical one given by the linearized theory. The inner problem requires a local formulation which corresponds to a local subsonic flow past a parabola in a plane normal to the leading edge. The inner solution is given explicitly in the case of weakly subsonic flows. Author (ESA)

N77-29109# New York Univ., N. Y. Dept. of Applied Science.

DEVELOPMENT AND AERODYNAMICS OF PROBOSCIOID ABLATING NOSE TIPS Final Report, 1 May 1974 - 31 Oct. 1975

R. Vaglio-Laurin Mar. 1977 36 p refs
(Contract F44620-74-C-0074)
(AD-A038835; AFOSR-77-0542TR) Avail: NTIS HC A03/MF A01 CSCL 20/4

Rationalization of slender concave shapes on ablating nose tips is obtained in terms of composite laminar/turbulent self-preserving solutions to the nose recession problem. The occurrence of subcritical and critical (violently oscillatory) flow conditions is discussed and associated with specific geometrical characteristics of the ablating nose shape. The presence of distinct oscillatory modes is noted for both the subcritical and critical cases, and the distinct underlying inviscid instability mechanisms are pointed out. On that basis numerical flow analyses by extension of available unsteady inviscid flow models is suggested, and the nature of the required extensions is outlined. Author (GRA)

N77-29110# Army Missile Research and Development Command, Redstone Arsenal, Ala. Aeroballistics Directorate.

A SUMMARY OF AERODYNAMIC CHARACTERISTICS FOR WRAP-AROUND FINS FROM MACH 0.3 TO 3.0

James A. Humphrey and Calvin W. Dahlke 1 Mar. 1977 235 p refs
(AD-A038143) Avail: NTIS HC A11/MF A01 CSCL 16/2

Wrap-around fin effectiveness for tube-launched missiles was investigated in a series of 6 wind tunnel tests. Wind tunnels were AEDC Propulsion Wind Tunnel, NASA/Langley Research Center Unitary Plan Wind Tunnel and McDonnell Douglas 4-foot Trisonic Wind Tunnel. Mach number range was 0.3 to 3.0. The basic model was a 2-caliber secant ogive nose with an 8-caliber cylindrical afterbody and 21 fin configurations. Variations in the coefficients are presented for changes in fin geometry including taper ratio and leading edge sweep angle, aspect ratio, exposed semi-span, and root chord length; opening angle, fully closed to 10 deg past fully open; and body step down. Author (GRA)

N77-29065*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

METHODS OF ANALYZING WIND-TUNNEL DATA FOR DYNAMIC FLIGHT CONDITIONS

Charles J. Donlan and I. G. Recant *In its* Collected Works of Charles J. Donlan [1976] 43 p refs (For primary document see N77-29059 20-01)
(NACA-TN-828) Avail: NTIS HC A99/MF A01 CSCL 01A

N77-29069*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

THE LATERAL FLYING QUALITIES OF THE BELL XP-77 AIRPLANE AS ESTIMATED FROM FULL-SCALE TUNNEL TESTS, 16 JUNE 1944

Charles J. Donlan and K. R. Czarnecki *In its* Collected Works of Charles J. Donlan [1976] 23 p refs Sponsored in part by Army (For primary document see N77-29059 20-01)
Avail: NTIS HC A99/MF A01 CSCL 01A

N77-29071*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

WIND-TUNNEL TESTS OF A 1/4 SCALE MODEL OF THE

BELL XS-1 TRANSONIC AIRPLANE. 1: LONGITUDINAL STABILITY AND CONTROL CHARACTERISTICS
Charles J. Donlan, W. B. Kemp, and E. C. Polhamus *In its* Collected Works of Charles J. Donlan [1976] 78 p refs (For primary document see N77-29059 20-01)
(DA Proj. 653)
(L6D12) Avail: NTIS HC A99/MF A01 CSCL 01A

N77-29074*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LOW-SPEED WIND-TUNNEL INVESTIGATION OF THE LONGITUDINAL STABILITY CHARACTERISTICS OF A MODEL EQUIPPED WITH A VARIABLE-SPEED WING, 23 MAY 1949
Charles J. Donlan and William C. Sleeman, Jr. *In its* Collected Works of Charles J. Donlan [1976] 43 p refs (For primary document see N77-29059 20-01)
(L9B18) Avail: NTIS HC A99/MF A01 CSCL 01A

N77-29075*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ESTIMATED TRANSONIC FLYING QUALITIES OF A TAILLESS AIRPLANE BASED ON A MODEL INVESTIGATION, 8 JUNE 1949
Charles J. Donlan and Richard E. Kuhn *In its* Collected Works of Charles J. Donlan [1976] 62 p refs (For primary document see N77-29059 20-01)
(L9D08) Avail: NTIS HC A99/MF A01 CSCL 01A

N77-29077*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A COMPARISON OF THE AERODYNAMIC CHARACTERISTICS AT TRANSONIC SPEEDS OF FOUR WING-FUSELAGE CONFIGURATIONS AS DETERMINED FROM DIFFERENT TEST TECHNIQUES, 4 OCTOBER 1960
Charles J. Donlan, Boyd C. Myers, II, and Axel T. Mattson *In its* Collected Works of Charles J. Donlan [1976] 65 p refs (For primary document see N77-29059 20-01)
(L5OH02) Avail: NTIS HC A99/MF A01 CSCL 01A

N77-29079*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN ASSESSMENT OF THE AIRPLANE DRAG PROBLEM AT TRANSONIC AND SUPERSONIC SPEEDS, 15 JULY 1974
Charles J. Donlan *In its* Collected Works of Charles J. Donlan [1976] 16 p refs Presented at Meeting of NACA Comm. on Aerodyn., Langley Station, Va., 28 Apr. 1954 (For primary document see N77-29059 20-01)
(L54F16) Avail: NTIS HC A99/MF A01 CSCL 01A

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N77-29111*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
REAL-TIME MANNED SIMULATION OF ADVANCED TERMINAL AREA GUIDANCE CONCEPTS FOR SHORT-HAUL OPERATIONS
Leonard Tobias and Paul J. OBrien Washington Aug. 1977 33 p refs Prepared in cooperation with the Natl. Aviation Facilities Exptl. Center, Atlantic City, N. J.
(NASA-TN-D-8499; A-6841) Avail: NTIS HC A03/MF A01 CSCL 17G

A real-time simulation was conducted of three-dimensional area navigation and four-dimensional area navigation equipped (STOL) aircraft operating in a high-density terminal area traffic environment. The objectives were to examine the effects of 3D RNAV and 4D RNAV equipped aircraft on the terminal area traffic efficiency, and to examine the performance of an air traffic control system concept and associated controller display proposed for use with advanced RNAV systems. Three types of STOL aircraft were simulated each with different performance capabilities. System performance was measured in both the 4D mode and in a 3D mode; the 3D mode, used as a baseline, was simply the 4D mode less any time specification. The results show that communications workload in the 4D mode was reduced by about 35 percent compared to the 3D, while 35 percent more traffic was handled with the 4D. Aircraft holding time in the 4D mode was only 30 percent of that required in the 3D mode. In addition, the orderliness of traffic was improved significantly in the 4D mode. Author

N77-29112# Civil Aeromedical Inst., Oklahoma City, Okla.
AN EPIDEMIOLOGIC INVESTIGATION OF OCCUPATION, AGE AND EXPOSURE IN GENERAL AVIATION ACCIDENTS
Charles F. Booze Apr. 1977 22 p refs
(AD-A040978; FAA-AM-77-10) Avail: NTIS HC A02/MF A01 CSCL 01/2

A census of general aviation accident-involved airmen records was studied. Population comparison data for occupation, age, exposure, and other epidemiologic profile information were obtained from a sample of currently certified airmen medical records. Author

N77-29113# National Aviation Facilities Experimental Center, Atlantic City, N. J.
ANALYSIS OF SELECTED GENERAL AVIATION STALL/SPIN ACCIDENTS Final Report, Feb. - Jun. 1975
Jack Shrager Apr. 1977 90 p refs
(FAA Proj. 184-520-100)
(AD-A040824; FAA-NA-77-2; FAA-RD-77-41) Avail: NTIS HC A05/MF A01 CSCL 01/2

An automated data search of existing general aviation data bases was employed in an effort to relate aircraft stall/spin accident history to general design characteristics. The technique utilized a chi square analysis to evaluate a stall/spin history of selected aircraft. The statistical analysis indicated that accident rates are influenced by aircraft usage, and by pilot experience. Low horsepower, low stallspeed aircraft have a higher propensity to stall/spin accidents, the highest incidence being in the takeoff phase of flight. Author

N77-29114*# Summerfield Associates, Santa Monica, Calif.
A STUDY OF COMMUTER AIRLINE ECONOMICS Final Report
John R. Summerfield Dec. 1976 24 p refs
(NASA Order A-29917-B)
(NASA-CR-152035) Avail: NTIS HC A02/MF A01 CSCL 05C

Variables are defined and cost relationships developed that describe the direct and indirect operating costs of commuter airlines. The study focused on costs for new aircraft and new aircraft technology when applied to the commuter airline industry. With proper judgement and selection of input variables, the operating costs model was shown to be capable of providing economic insight into other commuter airline system evaluations. J.H.

N77-29115# Naval Air Development Center, Warminster, Pa. Crew Systems Dept.
DEVELOPMENT OF AN INFLATABLE HEAD/NECK RESTRAINT SYSTEM FOR EJECTION SEATS Interim Report
Thomas J. Zenobi 28 Feb. 1977 32 p
(AD-A038762; NADC-76357-40) Avail: NTIS HC A03/MF A01 CSCL 06/7

A ring-shaped inflatable head/neck restraint system for ejection seats is being developed at the Crew Systems Department, NADC. The purpose of this system is to reduce neck injuries due to violent forward head rotation at the time of ejection thrust and parachute opening shock. Inflation of the neck ring will be conducted by a solid propellant gas generator. Design considerations include form-and-fit, cost effectiveness, packaging and integration into life support equipment. Author (GRA)

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N77-29116 Virginia Univ., Charlottesville.
A CHARGE COUPLED DEVICE MATCHED/FILTER WITH APPLICATION TO OMEGA NAVIGATION Ph.D. Thesis
Harry F. Benz 1976 154 p
Avail: Univ. Microfilms Order No. 77-7563

An application of the charge coupled device analog signal processor to simplify a navigational receiver problem for the Omega navigational network is discussed. The CCD technology, sampled analog signal processing, omega navigation, the conceptual signal processing element and the design of such a device are reviewed and concluding remarks are included.
Dissert. Abstr.

N77-29117# National Aviation Facilities Experimental Center, Atlantic City, N. J.
LONGITUDIAL SEPARATION ANALYSIS OF THE CENTRAL EAST PACIFIC TRACK SYSTEM Final Report, Dec. 1973 - Jun. 1974
Wayne E. Smoot Jun. 1977 109 p refs
(AD-A040759; FAA-NA-76-39; FAA-EM-77-3) Avail: NTIS HC A06/MF A01 CSCL 01/2

An evaluation of aircraft Mach number spacing and inertial navigation systems is represented, as regards their impact on longitudinal separation and collision risk in the Central East Pacific. A nomograph was produced for predicting maximum expected changes in longitudinal separation of aircraft flying on long distance transoceanic flights. Results indicate that a statistically significant difference in maintaining longitudinal separation exists between those aircraft employing Mach number spacing techniques and those not using the techniques, and likewise between aircraft with more sophisticated air data systems than those without. Collision risk from loss of longitudinal separation was found to be at an acceptable level. Author

N77-29118# Federal Aviation Administration, Washington, D.C.
ALASKAN AIR NAVIGATION REQUIREMENTS. VOLUME 1: OVERVIEW Final Report
A. A. Simolunas and G. H. Quinn Jan. 1977 75 p refs
(AD-A040664; FAA-RD-76-27-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 17/7

The unique air navigation problems of the Alaskan Region are described. Present and future navigation aids are described relative to their applicability to this area. Conclusions as to the near term and far term feasibility of these alternatives are summarized. Recommendations for a near term solution are presented using VORTAC, NDB, and DME systems. An operational feasibility system using Differential Omega is also described for a possible far term solution. Author

N77-29119# Systems Control, Inc., Palo Alto, Calif.
AREA NAVIGATION ROUTE WIDTH REQUIREMENTS Final Report
A. R. Stephenson and W. H. Clark Dec. 1976 119 p refs
(Contract DOT-FA72WA-3098)
(AD-A040153; FAA-RD-77-21) Avail: NTIS HC A06/MF A01 CSCL 01/2

Route width requirements for both high altitude enroute and terminal areas are quantified, based on the impact of route width, on route efficiency, airspace capacity, and route length. Results of this study, which based on analysis of specific, high traffic demand geographical areas, indicate that there is a requirement to eliminate the current splayed route widths and provide constant width routes, but that there is no requirement for reduction of route widths below a constant + or - 4 nm in the high altitude enroute structure, or below the + or - 2 nm or + or - 4 nm, in the high altitude enroute structure, or below the + or - 2 nm or + or - 4 nm, dependent upon distance from the VORTAC, which are currently required in the terminal area.
Author

N77-29120# Stanford Research Inst., Menlo Park, Calif.
ADVANCED PRODUCTIVITY ANALYSIS METHODS FOR AIR TRAFFIC CONTROL OPERATIONS Final Report, Jan. 1974 - Dec. 1976
Paul L. Tuan, H. Steven Procter, and George J. Couluris Dec. 1976 199 p refs
(Contract DOT-TSC-1128)
(AD-A035095; DOT-TSC-FAA-76-27; FAA-RD-76-164) Avail: NTIS HC A09/MF A01 CSCL 17/7

A description of the air traffic control productivity analysis methods is reported. The relative capacity estimating process models the traffic handling capabilities of individual sectors in terms of routine, surveillance, and conflict processing workloads. The air traffic flow model simulates a multisector network by tracing aircraft flows from sector to sector and measuring traffic loadings, workload requirements, and delays under given sets of traffic input parameters and congestion relief strategy. Author

N77-29121# Sierra Research Corp., Buffalo, N. Y.
RTA TACAN ANTENNA MODIFICATIONS FOR AZIMUTH PERFORMANCE Interim Report
J. Keptner Oct. 1976 109 p refs
(Contract DOT-FA75WA-3634)
(AD-A041414; FAA-RD-77-58; TR-1451) Avail: NTIS HC A06/MF A01 CSCL 17/7

Operational characteristics of the modified RTA-2 antenna were assessed. Performing installation, checkout, flight test, data reduction and analysis were evaluated. Problems causing azimuth restrictions were analyzed to establish the possible improvements which can be identified using the modified RTA-2 antenna. Field and engineering work performed were summarized, along with descriptions of the equipment and its performance. Results indicate that the modified RTA-2 antenna provides improvement at sites having certain azimuth performance problems. Author

N77-29122# Systems Control, Inc., Palo Alto, Calif.
AN OPERATIONAL EVALUATION OF OMEGA FOR CIVIL AVIATION OCEANIC NAVIGATION Final Report, Aug. 1975 - Feb. 1977
F. Karkalik and R. Wischmeyer Feb. 1977 274 p refs
(Contract DOT-FA75WA--3662)
(AD-A041095; FAA-RD-77-65) Avail: NTIS HC A12/MF A01 CSCL 17/7

Interest in Omega navigation for satisfying oceanic air navigation requirements is rapidly increasing. Omega is under serious consideration by major airlines as a Loran-A replacement. A flight evaluation program performed on oceanic routes to Central and South America, and over the Atlantic and Pacific Oceans is described. The primary objective was to determine the operational reliability and suitability of Omega navigation for satisfying oceanic air navigation requirements. Omega was found to be a satisfactory Loran-A replacement, with adequate signal strengths and geometries in most areas evaluated. Author

N77-29123# West Virginia Univ., Morgantown. Dept. of Electrical Engineering.
AIRCRAFT ANTENNA ANALYSIS AND MICROWAVE LANDING SYSTEM (MLS) APPLICATIONS Final Summary Report, 1 Jan. 1974 - 31 Dec. 1975
Constantine A. Balanis and Yuk-Bun Cheng 31 Jan. 1976 223 p refs
(Contract DOT-OS-40013)
(AD-A041484; FAA-RD-76-37) Avail: NTIS HC A10/MF A01 CSCL 01/2

Analytical methods for predicting the radiation characteristics of antennas on aircraft were developed. Diffraction techniques in conjunction with other classical electromagnetic, methods were used to take into account contributions from various structural features of an airframe. Computed values were compared with measured data of antennas on scaled model aircraft. A very good agreement between theory and experiment was indicated. Computations were made for antennas on full scale aircraft with the frequency of operation remaining within the proposed band for the MLS. A circumferential aperture, mounted below the

nose or above the cockpit of a Boeing 747 provides the most attractive coverage for MLS application. Author

N77-29124# Federal Aviation Administration, Washington, D.C.

BOSTON AIR ROUTE TRAFFIC CONTROL CENTER (ARTCC) LIGHTING STUDY Final Report, Apr. - Nov. 1976

Alan J. Kopala, Charles M. Hall (Raytheon Co., Sudbury, Mass.), and Richard M. Carr (Raytheon Co., Sudbury, Mass.) May 1977 163 p refs

(Contract DOT-FA76WA-3738)

(AD-A041324; FAA-RD-76-203) Avail: NTIS HC A08/MF A01 CSCL 17/7

Work at an air route traffic control center was accomplished in reducing reflections on the faceplates of the plan view displays while increasing the level of ambient lighting. This was intended to improve the observation of flight data by air traffic controllers, and to facilitate reading and walking in the immediate aisle area. Lighting experts identified glare and reflection sources and lighting deficiencies, measured their various intensities with photometric test equipment, and provided practical suggestions to rectify the lighting problems. The results of this project were the significant reduction of reflections and glare, and an increase in the ambient illumination. Author

N77-29125# Transportation Systems Center, Cambridge, Mass.

ILS GLIDE SLOPE PERFORMANCE PREDICTION MULTIPATH SCATTERING Final Report, Jul. 1975 - Mar. 1976

S. Morin, D. Newsom, and M. Scotto Dec. 1976 81 p ref

(AD-A035298; DOT-TSC-FAA-76-16; FAA-RD-76-216) Avail: NTIS HC A05/MF A01 CSCL 07/7

A mathematical model has been developed which predicts the performance of instrument landing glide slope systems subject to multipath scattering and the effects of irregular terrain contours. The model is discussed in detail and then applied to a test case for purposes of illustration. A complete listing of all computer programs has been appended to the report. Author

N77-29126# National Aviation Facilities Experimental Center, Atlantic City, N. J.

EVALUATION OF RADIO REMOTE CONTROL SYSTEM FOR AIRPORT VISUAL AIDS Final Report, Nov. 1975 - Aug. 1976

Bret B. Castle Jun. 1977 18 p

(AD-A041603; FAA-NA-76-51; FAA-RD-77-67) Avail: NTIS HC A02/MF A01 CSCL 17/7

An evaluation was made to determine if a particular radio remote control system could provide reliable control of distant airport visual aids in place of laying lengthy control cables to the system's power regulators. Simple operation and flexibility of usage were required of the system, as well as continual monitoring of the status of the remote stations, emergency operation during electrical power failures, and reliability of operation approaching hard-wire systems. Results show that during the 5,000 hours of testing the system worked well, except for high and low operating temperature problems caused by the use of unreliable commercial components in the transceiver. It was recommended that following transceiver improvements, operational evaluation in-service type tests be performed on the system in an operating airport environment. Author

N77-29127# Lincoln Lab., Mass. Inst. of Tech., Lexington.

DEVELOPMENT OF A DISCRETE ADDRESS BEACON SYSTEM Quarterly Technical Summary, 1 Jan. - 31 Mar. 1977

1 Apr. 1977 30 p

(Contracts DOT-FA72WAI-261; FAA Proj. 034-241-012)

(AD-A041089; FAA-RD-77-64) Avail: NTIS HC A03/MF A01 CSCL 17/7

Results to date of analytical studies, laboratory and flight experiments, and software developments supporting the concept feasibility and performance definition phase of the discrete address beacon system are presented. Author

N77-29128# Transportation Systems Center, Cambridge, Mass.

USER'S MANUAL FOR GENERALIZED ILSGLD-ILS GLIDE SLOPE PERFORMANCE PREDICTION: MULTIPATH SCATTERING Final Report, Jul. 1975 - Mar. 1976

S. Morin, D. Newsom, and M. Scotto Nov. 1976 81 p refs

(AD-A034492; DOT-TSC-FAA-76-19; FAA-RD-76-186) Avail: NTIS HC A05/MF A01 CSCL 17/7

The computer program package for the generalized ILSGLD scattering model is presented. The text includes a complete description of the program as well as a brief outline of the instrument landing system and antenna patterns. The program listings are included as appendixes, and contain both input generation programs and output plotting programs. Author

N77-29129# Ohio Univ., Athens. Dept. of Electrical Engineering.

THE PERFORMANCE OF THE NULL-REFERENCE GLIDE-SLOPE SYSTEM IN THE PRESENCE OF DEEP SNOW, 1975 - 1976 Final Report, Dec. 1975 - May 1976

Lawrence H. Mitchell and Richard H. McFarland Jan. 1977 50 p

(Contract DOT-FA76WA-3764)

(AD-A041139; FAA-RD-77-24; EER29-1) Avail: NTIS HC A03/MF A01 CSCL 17/7

An experimental glide slope established at 330.8 MHz on a runway at the airport in Houghton County, Michigan was used for measuring response to ground plane snow-cover up to 34 inches. Results indicate that the path angle increases approximately 0.10 degree for each foot of snow cover, and no significant deterioration occurs in path width or clearance. Special far-field monitoring using a two-frequency capture type monitor was only marginally successful. Author

N77-29130# Transportation Systems Center, Cambridge, Mass.

USER'S MANUAL FOR ILSS (REVISED ILSLOC): SIMULATION FOR DEROGATION EFFECTS ON THE INSTRUMENT LANDING SYSTEM Final Report, Aug. 1973 - Mar. 1976

O. Chin, L. Jordan, D. Kahn, S. Morin, D. Newsom, and M. Scotto Dec. 1976 121 p ref

(AD-A035690; DOT-TSC-FAA-76-7; FAA-RD-76-217) Avail: NTIS HC A06/MF A01 CSCL 17/7

The complete ILSS computer program package is presented. A thorough description of the program and a listing with comments are included, as well as a brief description of the instrument landing system and antenna patterns. A test case has been created and the figures of the case are incorporated in the report. Author

N77-29131# European Space Agency, Paris (France).

STUDY OF A DRAG-FREE SATELLITE. PRESENTATION OF THE PROJECT AND SATELLITE PILOTING

Marcel Bismut, Jacques Beaussier, Alain Bernard, Jean-Louis Boulay, Michel Gay et al Jun. 1977 61 p refs Transl. into ENGLISH of 'Etude d'un Satellite de Navigation a Trainee Compensee. Presentation du Projet et Pilotage du Satellite', ONERA, Paris Report ONERA-NT-1976-10, 1976 Original report in FRENCH previously announced as N77-25142

(ESA-TT-382; ONERA-NT-1976-10) Avail: NTIS HC A04/MF A01

The Nautex project is intended as an experimental phase aimed at demonstrating the feasibility of a national navigation system, the Naute system (NAvigation by Use of Established Trajectories), based on a drag-free satellite. After a general presentation of the project, the work done at ONERA, in cooperation with CNES (the French Space Agency), is described with a view to defining a last draft of the drag-free satellite piloting system. The main characteristics of a position detector derived from the Cactus accelerometer are optimized from the results of internal perturbation evaluations, taking into account the chracteristics of the motors ensuring the piloting. The piloting law was studied for the operational phase, with drag compensation, and for that during which the proof mass of the position detector is acquired. Author (ESA)

N77-29132# European Space Agency, Paris (France).

STUDY OF A DRAG-FREE SATELLITE: ITS USE FOR NAVIGATION

Jean Besson, Elie Haziza, Claude Jamy, Pierre Wever et al Jun. 1977 36 p refs Transl. into ENGLISH of 'Etude d'un Satellite de Navigation a Trainee Compensee. Son Utilisation pour la Navigation', ONERA, Paris Report ONERA-NT-1976-12, 1976 Original report in FRENCH previously announced as N77-25143

(ESA-TT-383; ONERA-NT-1976-12) Avail: NTIS HC A03/MF A01

Work carried out in cooperation with CNES (the French Space Agency) to ascertain the advantages to be expected from the use of a drag free satellite in a navigation system is presented. These advantages were analyzed through studying the localization precision and the alleviation of processing by the user. A numerical simulation, performed on several realistic configurations of the system, permitted determination of the various causes of error. It led to the conclusion that the user's localization precision is related mainly to that of the satellite orbit control. The alleviation of the measurement processing by the user, brought about by the a priori knowledge of the satellite ephemerides, justified a feasibility study of a low cost system adapted to the general navigation, for which the localization precision would be of the order of one nautical mile. Author (ESA)

N77-29133# Champlain Technology, Inc., West Palm Beach, Fla.

AN OPERATIONAL FLIGHT TEST EVALUATION OF A LORAN-C NAVIGATOR Final Report

M. Hughes and R. J. Adams Mar. 1977 127 p refs

(Contract DOT-CG-63154-A)

(AD-A039498; USCG-D-9-77) Avail: NTIS HC A07/MF A01 CSCL 17/7

This report presents the results of an operational test and evaluation of a Loran-C navigation system. The tests were performed in a Coast Guard HH-52A helicopter from 21 September to 19 October 1976. The flight test profiles, procedures and test objectives were developed to determine the applicability of the prototype Loran-C navigator to Coast Guard operations as well as to assess the functional and accuracy performance of the Loran-C navigator operating as an area navigation system in the National Airspace System. The operational testing reported in this document includes search and rescue missions as well as surveillance and enforcement missions. The former consisted of evaluating the Loran-C navigator during creeping line, sector, and expanding square search patterns. The latter involved performing low altitude hovers over fixed and movable objects and documenting Loran-C accuracy and repeatability. This latter data is also directly applicable to the operations of the off-shore oil industry. GRA

N77-29134# Federal Aviation Administration, Washington, D.C. Office of Management Systems.

FAA AIR TRAFFIC ACTIVITY, CALENDAR, YEAR 1976 Semiannual Report

Patricia Wilson 31 Dec. 1976 236 p

(AD-A040474) Avail: NTIS HC A11/MF A01 CSCL 01/2

This report furnishes terminal and enroute air traffic activity information of the National Airspace System. The data have been reported by the FAA-operated Airport Traffic Control Towers (ATCTs), Air Route Traffic Control Centers (ARTCCs), Flight Service Stations (FSSs), Combined Station Towers (CS/Ts), International Flight Service Stations, (IFFSSs), and Approach Control Facilities. Author (GRA)

N77-29135# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.

EXPERIMENTAL RESEARCH ON THE PROPAGATION OF LORAN-C SIGNALS. VOLUME D. DATA AND ANALYSIS

L. F. Fehlner, T. W. Jerardi, T. A. McCarty, R. G. Roll, and R. R. Smith Jan. 1977 404 p ref 4 Vol.

(Contract N00017-72-C-4401)

(AD-A040320; APL/JHU-TG-1298D) Avail: NTIS MF A01 CSCL 17/7

This report (Volume D of TG 1298) documents the data that were recorded and the analyses that were performed in conjunction with an experiment conducted by The Johns Hopkins University Applied Physics Laboratory for the U.S. Air Force and the Defense Advanced Research Projects Agency to determine the validity of one facet of the theory of groundwave propagation at 100 kHz. Volume A is the summary report, Volume B describes test operations, and Volume C describes the measurement system. The goal of the experiment was to determine if an analytic function could be developed for operational use that relates secondary phase factor to envelope to cycle difference so that geodetic position can be computed, accurately and in real time, from Loran-C coordinates. Field test data were collected and analyzed. They show trends that tend to support the hypothesis that the desired functional relationship exists, at least under certain conditions. Additional analysis and perhaps tests will be necessary to define these conditions or to prove conclusively the existence of such a relationship. Author (GRA)

N77-29136# Army Engineer Topographic Labs., Fort Belvoir, Va.

PLATFORM ORIENTATION SYSTEM TEST PROGRAM

Glenn W. Schmeidel Nov. 1976 27 p

(DA Proj. 1S7-64716-D-578)

(AD-A040599; ETL-0100) Avail: NTIS HC A03/MF A01 CSCL 17/7

This report discusses a limited field test performed on the POS(Platform Orientation System)-406. The function of the POS-406 is to provide a grid, true, or magnetic north reference to ground vehicles. The objective of this test program was to evaluate a magnetic type of north-seeker as the north reference in future FOV (Forward Observer Vehicle) development. Based upon the analysis of data obtained in this test, future FOV planning and development should include both magnetic and gyrocompass types of north references. Author (GRA)

N77-29137# Ballistic Research Labs., Aberdeen Proving Ground, Md.

COMPARISON OF THEORETICAL AND MEASURED SIGNAL AND NOISE OUTPUTS OF A PASSIVE 35-GHz RADIOMETER Final Report

Orrin C. Kaste Apr. 1977 59 p refs

(DA Proj. 1L6-62618-AH-80)

(AD-A040366; BRL-MR-2745) Avail: NTIS HC A04/MF A01 CSCL 17/7

Two expressions for calculating radiometer antenna temperature changes when a target is present are derived and compared favorably with a simple expression frequently used in the literature. One of the new expressions can be used to calculate the output signal pulse of a radiometer as it passes near or over a target, and can be used when the radiometer antenna axis is tilted from the vertical. Experimental data are compared with theoretical data; agreement is generally very good. A theoretical expression for the noise output of a radiometer was obtained from the literature. Values from this expression are found to be in good agreement with noise data obtained from laboratory and field measurements. Author (GRA)

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N77-29138*# Old Dominion Univ. Research Foundation, Norfolk, Va. School of Engineering.

DYNAMIC CHARACTERISTICS OF ROTOR BLADES WITH PENDULUM ABSORBERS Progress Report, 1 Jan. - 30 Jun. 1977

V. R. Murthy and G. L. Goglia Jul. 1977 18 p refs

(Grant NsG-1370)

(NASA-CR-153929) Avail: NTIS HC A02/MF A01 CSCL 01C

The point transmission matrix for a vertical plane pendulum on a rotating blade undergoing combined flapwise bending, and chordwise bending and torsion is derived. The equilibrium equation of the pendulum is linearized for small oscillations about the steady state. A FORTRAN program was written for the case of a vertical plane pendulum attached to a uniform blade with flapwise bending degree of freedom for cantilever boundary conditions. The frequency has a singular value right at the uncoupled pendulum natural frequency and thus introduces two frequencies corresponding to the nearest natural frequency of the blade without pendulum. In both of these modes it was observed that the pendulum deflection is large. One frequency

can be thought of as a coupled pendulum frequency and the other as a coupled bending and pendulum frequency. Author

N77-29139*# Operations Research, Inc., Silver Spring, Md.
AVIATION AND PROGRAMMATIC ANALYSES; VOLUME 1, TASK 1: AVIATION DATA BASE DEVELOPMENT AND APPLICATION
28 Mar. 1977 114 p refs 3 Vol.
(Contract NAS5-23477)
(NASA-CR-152581) Avail: NTIS HC A06/MF A01 CSCL 01C

A method was developed for using the NASA aviation data base and computer programs in conjunction with the GE management analysis and projection service to perform simple and complex economic analysis for planning, forecasting, and evaluating OAST programs. Capabilities of the system are discussed along with procedures for making basic data tabulations, updates and entries. The system is applied in an agricultural aviation study in order to assess its value for actual utility in the OAST working environment. A.R.H.

N77-29140*# Operations Research, Inc., Silver Spring, Md.
AVIATION AND PROGRAMMATIC ANALYSES. VOLUME 2, TASK 2: IDENTIFICATION OF PLANNING FACTORS AND ACTIVITIES Final Report
28 Mar. 1977 250 p refs 3 Vol.
(Contract NAS5-23477)
(NASA-CR-152582) Avail: NTIS HC A11/MF A01 CSCL 01C

For abstract, see N77-29139.

N77-29141*# Operations Research, Inc., Silver Spring, Md.
AVIATION AND PROGRAMMATIC ANALYSES. VOLUME 3, TASK 3: DEVELOPMENT OF SPECIAL ISSUE PAPERS Final Report
28 Mar. 1977 204 p refs 3 Vol.
(Contract NAS5-23477)
(NASA-CR-152583) Avail: NTIS HC A10/MF A01 CSCL 01C

For abstract, see N77-29139.

N77-29142*# Kansas Univ. Center for Research, Inc., Lawrence.
A STUDY OF COMMUTER AIRPLANE DESIGN OPTIMIZATION
J. Roskam, R. David Wyatt, Douglas A. Griswold, and James L. Hammer 31 Aug. 1977 276 p refs
(Grant NsG-2145)
(NASA-CR-154270; KU-FRL-313-4; SR-3) Avail: NTIS HC A13/MF A01 CSCL 01C

Problems of commuter airplane configuration design were studied to affect a minimization of direct operating costs. Factors considered were the minimization of fuselage drag, methods of wing design, and the estimated drag of an airplane submerged in a propellor slipstream; all design criteria were studied under a set of fixed performance, mission, and stability constraints. Configuration design data were assembled for application by a computerized design methodology program similar to the NASA-Ames General Aviation Synthesis Program. J.H.

N77-29143*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPATIBILITY CHECK OF MEASURED AIRCRAFT RESPONSES USING KINEMATIC EQUATIONS AND EXTENDED KALMAN FILTER
Vladislav Klein (George Washington Univ., Washington, D.C.) and James R. Schiess Washington Aug. 1977 49 p refs
(NASA-TN-D-8514; L-11420) Avail: NTIS HC A03/MF A01 CSCL 01C

An extended Kalman filter smoother and a fixed point smoother were used for estimation of the state variables in the six degree of freedom kinematic equations relating measured aircraft responses and for estimation of unknown constant bias and scale factor errors in measured data. The computing algorithm includes an analysis of residuals which can improve the filter performance and provide estimates of measurement noise characteristics for some aircraft output variables. The technique developed was demonstrated using simulated and real flight test data. Improved accuracy of measured data was obtained when the data were corrected for estimated bias errors. Author

N77-29144# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
COMPARISON BETWEEN THE STATISTICAL DISCRETE GUST METHOD AND THE POWER-SPECTRAL DENSITY METHOD
R. Noback 25 Nov. 1975 77 p refs Sponsored by Dept. of Civil Aviation
(NLR-TR-75158-U) Avail: NTIS HC A05/MF A01

These two methods of calculating aircraft design loads due to atmospheric turbulence were compared qualitatively and quantitatively on the basis of the load exceedance curves for certain aircraft models. It is shown that for the first and second order models without unsteady aerodynamic forces and within certain ranges of model-parameters the two methods give the same results for the design loads when the design criteria are also based on these types of models. It is shown that the methods are related to each other, giving the same results for simple first and second order airplane models. It is concluded that the statistical discrete gust method has no advantages and a number of disadvantages compared to the power spectral density method and is not suitable as an airworthiness requirement for the calculation of design loads. Author (ESA)

N77-29145# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
EQUATIONS FOR THE RESPONSE OF AN AIRPLANE TO NON-STATIONARY ATMOSPHERIC TURBULENCE PATCHES
R. Noback 8 Mar. 1976 62 p refs
(Contract NIVR-1775)
(NLR-TR-76056-U) Avail: NTIS HC A04/MF A01

A method to calculate the load exceedance curve for a linear system having a finite, modulated Gaussian process as input is described. The derivation is based on the use of ensemble averages, defined as the expected values at a certain point of time. The equations can be used for any airplane-transfer function to which the power spectral density method is applicable.
Author (ESA)

N77-29146# Army Materials and Mechanics Research Center, Watertown, Mass.
EVALUATION OF SCRATCH-AND SPALL-RESISTANT WINDSHIELDS Final Report
John R. Plumer and Wilson C. McDonald Dec. 1976 30 p
(AD-A038849; AMMRC-TR-76-39; AVSCOM-76-22) Avail: NTIS HC A03/MF A01 CSCL 06/17

A program was conducted to develop and assess materials configurations offering a potential improvement to the scratching and spalling problems present in existing Army helicopter windshields. Two prototype designs were fabricated for the UH-1 helicopter, flight tested at Ft. Rucker Alabama, and subjected to ballistic and bird impact tests while under flight-simulated conditions. The designs tested included an acrylic windshield (used as the standard), a monolithic polycarbonate windshield with an abrasion-resistant coating on both surfaces, and a glass-plastic composite using Chemcor and polycarbonate materials. GRA

N77-29147# Army Armament Material Readiness Command, Rock Island, Ill. Systems Analysis Directorate.
COST/SCHEDULE UNCERTAINTY ANALYSIS FOR VADS SHORT-RANGE RAM PRODUCT IMPROVEMENT PROGRAM Final Report
Norman H. Trier Feb. 1977 53 p refs
(AD-A039813; DRSAR/SA/N-55) Avail: NTIS HC A04/MF A01 CSCL 15/5

A cost/schedule uncertainty analysis was conducted on the short range (RAM) product improvement program (PIP) for the Vulcan Air Defense System (VADS). The short range PIP addresses the product improvements to the self-propelled (M163) and towed (M167) VADS, changes to VADS support and test equipment, and documentation of those changes in the appropriate technical manuals. The Venture Evaluation and Review Technique (VERT), a network analyzer, was used to simulate the VADS PIP from July 1, 1976 to the completed application of all product

improvements and the fielding of the new manuals and test equipment. Author (GRA)

N77-29060*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN APPROXIMATE SPIN DESIGN CRITERION FOR MONOPLANES, 1 MAY 1939
Oscar Seidman and Charles J. Donlan *In its* Collected Works of Charles J. Donlan [1976] 11 p refs (For primary document see N77-29059 20-01)
(NACA-TN-711) Avail: NTIS HC A99/MF A01 CSCL 01C

N77-29061*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SPIN TESTS OF A 1/20-SCALE MODEL OF THE XP-39 AIRPLANE, 15 MARCH 1939
Charles J. Donlan *In its* Collected Works of Charles J. Donlan [1976] 23 p refs Sponsored in part by Army (For primary document see N77-29059 20-01)
Avail: NTIS HC A99/MF A01 CSCL 01C

N77-29062*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SPIN TESTS OF A 1/20-SCALE MODEL OF THE XF4U-1 AIRPLANE, 12 JULY 1939
Charles J. Donlan *In its* Collected Works of Charles J. Donlan [1976] 47 p refs Sponsored in part by Navy (For primary document see N77-29059 20-01)
Avail: NTIS HC A99/MF A01 CSCL 01C

N77-29063*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SPIN TESTS OF 1/16-SCALE MODELS OF THE N3N-3 LANDPLANE AND SEAPLANE, 12 JANUARY 1940
Charles J. Donlan *In its* Collected Works of Charles J. Donlan [1976] 37 p refs Sponsored in part by Navy (For primary document see N77-29059 20-01)
Avail: NTIS HC A99/MF A01 CSCL 01C

N77-29064*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SPIN TESTS OF A LOW-WING MONOPLANE TO INVESTIGATE SCALE EFFECT IN THE MODEL TEST RANGE, MAY 1941
Charles J. Donlan *In its* Collected Works of Charles J. Donlan [1976] 23 p refs (For primary document see N77-29059 20-01)
(NACA-TN-807) Avail: NTIS HC A99/MF A01 CSCL 01C

N77-29068*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LATERAL STABILITY AND CONTROL TESTS OF THE XP-77 AIRPLANE IN THE NACA FULL-SCALE TUNNEL, 16 JUNE 1944
K. R. Czarnecki and Charles J. Donlan *In its* Collected Works of Charles J. Donlan [1976] 84 p refs Sponsored in part by Army (For primary document see N77-29059 20-01)
Avail: NTIS HC A99/MF A01 CSCL 01C

N77-29078*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CHARACTERISTICS OF SWEPT WINGS AT HIGH SPEEDS, 30 JANUARY 1952
Charles J. Donlan and Joseph Weil *In its* Collected Works of Charles J. Donlan [1976] 20 p refs (For primary document see N77-29059 20-01)
(L52A15) Avail: NTIS HC A99/MF A01 CSCL 01C

N77-29082*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PROPORTIONING THE AIRPLANE FOR LATERAL STABILITY
Charles J. Donlan *In its* Collected Works of Charles J. Donlan [1976] 6 p refs (For primary document see N77-29059 20-01)
Avail: NTIS HC A99/MF A01 CSCL 01C

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

N77-29148 Georgia Inst. of Tech., Atlanta.
A VORTEX WAKE ANALYSIS OF OPTIMUM HIGH BY-PASS RATIO DUCTED FANS Ph.D. Thesis
Damaraju Subramanya Janakiram 1976 177 p
Avail: Univ. Microfilms Order No. 77-7622

A consistent mathematical potential wake model is presented for the fan wake and the boundary sheets, and the compatibility relationships to be satisfied by each of the cylindrical boundary vortex sheets are obtained. It is shown that for the wake model to be consistent, the jet wake needs to satisfy certain conditions as far as the induced velocities in it are concerned. The compressibility and viscous effects are neglected in the analysis of the wake. Using the Biot-Savart law, the vortex strength distribution of the ultimate wake is found numerically and then is related to the blade bound vortex strength distribution. The expressions for the thrust, induced power, and induced efficiency are developed using integral theorems and evaluated numerically. The ultimate wake vortex model for a ducted fan with infinite number of blades is also developed. Dissert. Abstr.

N77-29149 Engineering Sciences Data Unit, London (England).
EFFECT OF INTAKE TOTAL PRESSURE LOSS ON NET THRUST AT TAKE-OFF: TURBOJET AND TURBO-FAN ENGINES
Mar. 1977 6 p
(ESDU-77001; ISBN-0-85678-172-5) For information on availability of series, sub-series, and other individual data items, write NTIS, attn: ESDU, Springfield, Va. 22161. HC $98.50

A method is given for estimating the effect of intake total pressure loss on the net thrust of turbojet and turbofan engines at takeoff conditions. The total pressure loss characteristics of typical intakes are included along with data for use in estimating the consequent reduction in net thrust. ESDU

N77-29150*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
IMPROVED HIGH PRESSURE TURBINE SHROUD Final Report, 26 Jun. 1974 - 24 Jan. 1977
I. I. Bessen, D. V. Rigney, and R. C. Schwab Feb. 1977 82 p (Contract NAS3-18905)
(NASA-CR-135181; R77AEG481) Avail: NTIS HC A05/MF A01 CSCL 21E

A new high pressure turbine shroud material has been developed from the consolidation of prealloyed powders of Ni, Cr, Al and Y. The new material, a filler for cast turbine shroud body segments, is called Genaseal. The development followed the identification of oxidation resistance as the primary cause of prior shroud deterioration, since conversion to oxides reduces erosion resistance and increases spalling under thermal cycled engine conditions. The NICrAlY composition was selected in preference to NIAL and FeCRALY alloys, and was formulated to a prescribed density range that offers suitable erosion resistance, thermal conductivity and elastic modulus for improved behavior as a shroud. Author

N77-29151# Lockheed-California Co., Burbank.
EXPERIMENTAL INVESTIGATIONS OF AERODYNAMIC NOISE DURING FISCAL YEARS 1974, 1975 AND 1976
J. D. Revell and G. J. Healy 15 Aug. 1977 134 p refs
(LR-27438) Avail: NTIS HC A07/MF A01 CSCL 20A

Arguments exist for expecting an airframe noise contribution related to the induced drag associated with dissipation of trailing vortices. Turbulence in the swirling shear layers surrounding the trailing vortices causes extra pressure fluctuations to be generated at the wing trailing edge; these fluctuations are described. The experimental effort on aerodynamic noise was devoted to free jet anechoic wind tunnel tests with airfoils and sting mounted models. The noise levels measured for scale model were higher than the theory at Mach numbers between 0.2 and 0.4 by a maximum of 5 db, gradually decreasing with Mach number. The increase in noise at low Mach numbers above the theory was associated with low Reynolds number laminar instability tones.
Author

N77-29152# IIT Research Inst., Chicago, Ill.
TURBINE ENGINE PARTICULATE EMISSION CHARACTERIZATION Final Report
Donald L. Fenton Sep. 1976 140 p refs
(Contract DOT-FA75WA-3722)
(AD-A041499; C-6352-10; FAA-RD-76-141) Avail: NTIS HC A07/MF A01 CSCL 21/5

A particulate material sampler was designed to be used in conjunction with commercial aircraft turbine engines. The engines of interest include a low bypass ratio turbofan, a mixed flow turbofan, and a high bypass ratio turbofan. The samples and information provided by the sampler included particle size distribution, particle size/shape characteristics, and particulate mass concentration. The influence of engine operating variables such as power setting and compressor inlet conditions on particle characteristics can be determined.
Author

N77-29153# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
FILM COOLED SMALL TURBINE BLADE RESEARCH. PART 2: FILM COOLING EFFECTIVENESS AT SIMULATED TURBINE CONDITIONS Semiannual Report, Dec. 1975-Jun. 1976
B. E. Richards, J. P. Ville, and C. Appels Jun. 1976 71 p refs
(Contract DAERO-75-074)
(VKI-TN-120) Avail: NTIS HC A04/MF A01

The overall study concerns an investigation on the cooling and aerodynamic problems associated with a high speed turbine cascade of small blade height for use on small gas turbines. The secondary flow behavior in turbines is presented in Vol. 2 of this report which is confined to the measurement of effectiveness of a film cooling system for a small turbine by injection through inclined holes. A short duration facility was used to provide isothermal wall data at flow conditions carefully selected to simulate those expected in an advance turbine. Appropriate heat and mass transfer equations were developed to illustrate the interpretation and usefulness of data obtained in this as yet relatively unconventional method. The measurements showed that: there are small increases in effectiveness for injection on convex surfaces compared to flat surfaces; a change in flow Reynolds number only slightly changes effectiveness; a lowering of the mainstream Mach number from 0.6 to 0.3 causes a sizable decrease in effectiveness; and a favorable pressure gradient, typical of that seen on a turbine blade also decreases considerably the effectiveness.
Author (ESA)

N77-29154# Dornier-System G.m.b.H., Friedrichshafen (West Germany).
DETERMINATION OF COMPRESSIBLE UNSTEADY AERODYNAMIC FORCES ON A FINITE NUMBER OF WEAKLY CURVED CASCADE OF ARBITRARY DEPTH IN PLANE FLOW [BESTIMMUNG KOMPRESSIBLER, INSTATIONAERER LUFTKRAEFTE AN EINER ENDLICHEN ZAHL SCHWACH GEKRUEMMTER KASKADENSCHAUFELN BELIEBIGER TIEFE IN EBENER STROEMUNG]
W. Schuler Bonn DOKZENTBw 1976 45 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung.
(BMVg-FBWT-76-24) Avail: NTIS HC A03/MF A01; DOKZENTBw, Bonn DM 30

The method described is based on the panel-technique, which allows the calculation of approximate unsteady aerodynamic forces on a finite, harmonically vibrating cascade consisting of slightly curved lifting surfaces (vanes) and boundary surfaces in a two-dimensional, compressible subsonic airstream. Some results obtained from applying the method to a special cascade are presented, and comparison is made with a proven method for the case of a single vane.
Author (ESA)

N77-29155# Politecnico di Torino (Italy). Ist. di Macchine e Motori per Aeromobili.
ANALYSIS OF UNSTEADY FLOW IN TURBOJET ENGINE AFTERBURNERS [ANALISI DEL MOTO NON STAZIONARIO IN POSTBRUCIATORI DI TURBOREATTORI]
Matteo Andriano and Luca Zannetti Oct. 1976 19 p refs In ITALIAN; ENGLISH summary
(Publ-185) Avail: NTIS HC A02/MF A01

Transients due to the fuel throttling and a variable geometry exhaust nozzle in turbojet engine afterburners were numerically investigated using a one-dimensional theory. An unsteady combustion model is proposed. Hyperbolic partial differential equations representative of unsteady flow and combustion are integrated by means of a finite difference method. Computational examples are described.
Author (ESA)

N77-29156# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
NOISE LEVELS OF JET TRANSPORT AIRCRAFT DURING INITIAL CLIMB
M. Lanzer, D. Brown, and J. B. Ollerhead Mar. 1977 39 p refs
(Contract SN/1170/012)
(TT-7702) Avail: NTIS HC A03/MF A01

Noise peak level data measured for 271 jet transport departure flights at minimum slant range distances of between 1000 ft. (305 m) and 6000 ft. (1830m) are given. The nose data, in D-weighted sound levels, dB(D), were obtained by analyses of noise history tape recordings each of which was accompanied by a photographic record of the flight track. Propagation laws, relating peak sound level and minimum slant range, are derived for ten different aircraft types and for two categorized groupings (2- and 4-engined turbofan aircraft). These empirical laws show that for the maximum power climb condition of flight, the radiated peak levels diminish at a rate of about 10 to 12 dB(D) per distance doubling. Directivity properties of the D-weighted sound level of selected aircraft are also derived from the sound history and photographic records. These are shown to be reasonably approximated by a spherically uniform radiation model.
Author (ESA)

N77-29157# McDonnell Aircraft Co., St. Louis, Mo.
AIRCRAFT HYDRAULIC SYSTEM DYNAMIC ANALYSIS. VOLUME 1: TRANSIENT ANALYSIS (HYTRAN). COMPUTER PROGRAM USER MANUAL Interim Technical Report
Gerry Amies, Ray Levek, and Dave Struessel Wright-Patterson AFB, Ohio AFAPL Feb. 1977 201 p
(Contract F33615-74-C-2016; AF Proj. 3145)
(AD-A038690; AFAPL-TR-76-43-Vol-1) Avail: NTIS HC A10/MF A01 CSCL 01/3

The hydraulic transient analysis (HYTRAN) computer program has been developed to simulate the response of a hydraulic system to sudden changes in flow demand by the system loads. For a selected system temperature, pump RPM, and initial steady state conditions, the program will calculate the pressures and flow amplitudes resulting from changes in flow demand or some other controller input. It will predict transient pressures due to waterhammer and the onset of cavitation due to the opening and closing of valves.
GRA

N77-29158# McDonnell Aircraft Co., St. Louis, Mo.
AIRCRAFT HYDRAULIC SYSTEMS DYNAMIC ANALYSIS. VOLUME 2: TRANSIENT ANALYSIS (HYTRAN). COMPUTER PROGRAM TECHNICAL DESCRIPTION Interim Technical Report
Gerry Amies, Ray Levek, and Dave Struessel Wright-Patterson AFB, Ohio AFAPL Feb. 1977 503 p refs

(Contract F33615-74-C-2016; AF Proj. 3145)
(AD-A039037; AFAPL-TR-76-43-Vol-2) Avail: NTIS HC A22/MF A01 CSCL 01/3

The hydraulic transient analysis (HYTRAN) computer program has been developed to simulate the response of a hydraulic system to sudden changes in flow demand by the system loads. For selected component temperatures, pump RPM, and initial steady state conditions, the program will calculate the pressures and flow amplitudes resulting from changes in flow demand or some other controller input. It will predict transient pressures due to waterhammer and the onset of cavitation due to the opening and closing of valves. The engineering input data to the program is normally available to a design engineer. When specialized components are required that are not covered by existing subroutines, these may be simulated by adding to the program. Author (GRA)

N77-29159# McDonnell Aircraft Co., St. Louis, Mo.
AIRCRAFT HYDRAULIC SYSTEM DYNAMIC ANALYSIS. VOLUME 3: FREQUENCY RESPONSE (HSFR). COMPUTER PROGRAM USER MANUAL Interim Technical Report
Gerry Amies and Bob Greene Wright-Patterson AFB, Ohio AFAPL Feb. 1977 77 p
(Contract F33615-74-C-2016; AF Proj. 3145)
(AD-A038691; AFAPL-TR-76-43-Vol-3) Avail: NTIS HC A05/MF A01 CSCL 01/3

The hydraulic system frequency response (HSFR) computer program was developed to simulate the dynamic response of a hydraulic system to the acoustic noise generated by the pump. Detailed instructions for modeling the system pump, lines, and components, and for using the program are presented. For a selected system pressure, temperature, flow, and pump speed range, the program calculates the pulsation pressure and energy levels generated by the pump. It predicts the amplitude and location of the resulting acoustical standing waves, and how these waves are transmitted and attenuated throughout the hydraulic system. The program may be used for acoustical analysis in the pressure side or both the pressure and return sides of the hydraulic system. GRA

N77-29160# McDonnell-Douglas Corp., St. Louis, Mo.
AIRCRAFT HYDRAULIC SYSTEM DYNAMIC ANALYSIS. VOLUME 4: FREQUENCY RESPONSE (HSFR). COMPUTER PROGRAM TECHNICAL DESCRIPTION Interim Technical Report
Gerry Amies and Bob Greene AFAPL Feb. 1977 203 p refs
(Contract F33615-74-C-2016; AF Proj. 3145)
(AD-A038884; AFAPL-TR-76-43-Vol-4) Avail: NTIS HC A10/MF A01 CSCL 01/3

The hydraulic system frequency response (HSFR) computer program was developed to simulate the dynamic response of a hydraulic system to the acoustic noise generated by the pump. A detailed technical description of the program is presented. For a selected system pressure, temperature, flow, and pump speed range, the program calculates the pulsation pressure and energy levels generated by the pump. It predicts the amplitude and location of the resulting acoustical standing waves, and how these waves are transmitted and attenuated throughout the hydraulic system. The program may be used for acoustical analysis in the pressure side or both the pressure and return sides of the hydraulic system. Estimated line lengths and sizes from preliminary design work give a good estimate of hydraulic system natural frequencies and pressure amplitudes. The program outputs plots of the peak flow, pressure, and impedance amplitudes of any selected harmonic of the pulsation noise versus pump speed for selected locations in the system. In addition, the program outputs plots of total acoustic energy density and intensity (power) versus pump speed. GRA

N77-29161# McDonnell-Douglas Corp., St. Louis, Mo.
AIRCRAFT HYDRAULIC SYSTEMS DYNAMIC ANALYSIS. VOLUME 5: STEADY STATE FLOW ANALYSIS (SSFAN). COMPUTER PROGRAM USER MANUAL Interim Technical Report
Ray Levek and Bob Young Wright-Patterson AFB, Ohio AFAPL Feb. 1977 106 p
(Contract F33615-74-C-2016; AF Proj. 3145)
(AD-A038611; AFAPL-TR-76-43-Vol-5) Avail: NTIS HC A06/MF A01 CSCL 01/3

SSFAN is a steady state hydraulic flow and pressure analysis computer program. Its primary purpose is to analyze non-linear resistance aircraft hydraulic systems. The program handles complex flow networks containing flow and/or pressure discontinuities such as unbalanced area actuators and check valves. Solutions for a combination of simultaneously operating subsystems are easily obtained. The program is designed using a building block approach so that new component or element models may be added with minimum change to the main program. The solution method is a matrix type, using iteration to obtain a final flow and pressure balance. The program internally corrects viscosities for pressure, determines whether flow is laminar, transition or turbulent for use of appropriate resistance factors, and corrects reservoir pressure for altitude effects. The program was written with the aircraft hydraulic system designer in mind. The terminology and units are commonly used terms such as fluid viscosity in centistokes, temperatures in degrees Fahrenheit and flow in gallons per minute. Conversion of units for calculation is accomplished internally in the program. Author (GRA)

N77-29162# McDonnell Aircraft Co., St. Louis, Mo.
AIRCRAFT HYDRAULIC SYSTEM DYNAMIC ANALYSIS. VOLUME 6: STEADY STATE FLOW ANALYSIS (SSFAN). COMPUTER PROGRAM TECHNICAL DESCRIPTION Interim Technical Report
Ray Levek and Bob Young Wright-Patterson AFB, Ohio AFAPL Feb. 1977 501 p refs
(Contract F33615-74-C-2016; AF Proj. 3145)
(AD-A038692; AFAPL-TR-76-43-Vol-6) Avail: NTIS HC A22/MF A01 CSCL 01/3

The SSFAN computer program analyzes steady-state hydraulic flow and pressure, primarily in aircraft. It uses a building block approach so that new elements or components can be added with minimum change to the rest of the program. The solution method is a matrix type, using an iterative technique to obtain a final flow balance. The program corrects viscosities for pressure; determines whether flow is laminar, transitive or turbulent, applies appropriate resistance factors; and corrects reservoir pressure for altitude. It handles complex flow networks containing flow and pressure discontinuities such as unbalanced area actuators. Author (GRA)

N77-29163# McDonnell Aircraft Co., St. Louis, Mo.
AIRCRAFT HYDRAULIC SYSTEM DYNAMIC ANALYSIS. VOLUME 7: TRANSIENT THERMAL ANALYSIS (HYTTHA). COMPUTER PROGRAM USER MANUAL Interim Technical Report
Ray Levek and Jeff Monroe Wright-Patterson AFB, Ohio AFAPL Feb. 1977 126 p
(Contract F33615-74-C-2016; AF Proj. 3145)
(AD-A038693; AFAPL-TR-76-43-Vol-7) Avail: NTIS HC A07/MF A01 CSCL 01/3

The Hydraulic Transient Thermal Analysis (HYTTHA) computer program has been developed to predict temperatures, and temperature gradients in hydraulic components and systems, due to changes in flow demands. The steady state flows and pressures throughout the system are used by the thermal portion of the program to predict fluid temperatures, line wall temperatures, component temperatures, and other component variables. GRA

N77-29164# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A METHOD FOR ANALYSIS OF ELECTROSTATIC PROBE SIGNALS RELATING TO JET-ENGINE MICRODISTRESSES M.S. Thesis
William Edward Gifford, III Dec. 1976 62 p refs
(AD-A038528; AFIT/GNE/PH/76-3) Avail: NTIS HC A04/MF A01 CSCL 14/2

Various methods of data reduction to correlate electrostatic probe signals with engine gas-path distress were developed and tested. These methods consisted of counting pulse signals, monitoring turbine and compressor vibrations, examining individual pulses to determine significant characteristics, and using the integrated areas of all pulses in a given test cycle to determine the level of engine distress. The systems developed were tested using tape recorded data from a TF-41 undergoing a simulated

flight endurance test at Detroit Diesel Allison Division in Indianapolis, Indiana. During the test, the LP2 turbine experienced a non-catastrophic failure due to a seal rub. Tapes recorded during the test indicate that the failure occurred over an 80 hour period in which large (350 msec long, 8 volts high) pulses were observed on accelerations. The vibration signature of the engine also changed during this period. A system which integrated the areas under the pulses showed a factor of 20 increase during the period of highest recorded distress. Author (GRA)

N77-29165# Texas A&M Univ., College Station. Dept. of Industrial Engineering.
ESTIMATION OF ENGINE REMOVAL TIMES AND PREDICTION OF REPLACEMENT REQUIREMENTS Final Report. 1 Dec. 1975 - 30 Sep. 1976
Laurence L. George Dec. 1976 145 p ref
(Contract F33615-76-C-3042; AF Proj. 7071)
(AD-A038076; AFFDL-TR-76-130) Avail: NTIS HC A07/MF A01 CSCL 21/5

The report contains a review of the actuarial method for estimation of engine lives, a suggestion to reduce the variance of the estimate by using variable age intervals, a description of alternative estimators that use all data on engine removal ages, a comparison of estimators, a sequential two sample test for obtaining a representative data set of engine lives, a review of the actuarial method and a simulation program for predicting replacement requirements, a next event simulation program for predicting engine requirements, and suggestions for more comprehensive models of engine performance and replacement. The first appendix contains the derivation of the maximum likelihood estimator for engine lives from a multiple risk model with a progressively censored sample. The second appendix describes variance reduction by antithetic variates for a next event replacement simulation. The third appendix describes the next event type simulation of operation of a fleet of aircraft with a single type of engine. GRA

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N77-29166*# Systems Control, Inc., Palo Alto, Calif.
IDENTIFICATION OF STABILITY DERIVATIVES FROM WIND TUNNEL TESTS OF CABLE-MOUNTED AEROELASTIC MODELS
Richard L. Mohr and W. Earl Hall, Jr. [1977] 124 p refs
(Contract NAS1-13938)
(NASA-CR-145123) Avail: NTIS HC A06/MF A01 CSCL 01C

The test models were mounted within the wind tunnel on a cable support system which allowed five degrees of freedom in the model's motion. A parameter identification algorithm was computer coded to calculate the maximum likelihood estimates of the stability and control derivatives based on an assumed structure of the equations of motion. Models of the F-14 aircraft and the space shuttle orbiter were tested in the transonic dynamics tunnel to demonstrate the feasibility of identifying aerodynamic coefficients from wind tunnel test data of cable-mounted models. Author

N77-29167# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
LONGITUDINAL MOMENT DEVIATIONS OF WINGS FOR LARGE ANGLES OF ATTACK IN SUBSONIC FLOW [LAENGSMOMENTENDERIVATIVE VON FLUEGELN BEI HOHEN ANSTELLWINKELN IN UNTERSCHALLSTROEMUNG]
C. P. Schneider and D. Nikolitsch Bonn DOKZENTBw 1976 71 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(BMVg-FBWT-76-26) Avail: NTIS HC A04/MF A01; DOKZENTBw, Bonn DM 30

The steady and quasisteady derivatives of the longitudinal stability of wings of arbitrary shape in subsonic flow were determined by means of the nonlinear Gersten theory. The theory was extended to include the compressibility influence of flow. Whenever possible, the results of the calculation were compared with the experiment. As an additional procedure to predict the unsteady pitching moment derivative, the momentum method of the incompressible slender body theory applicable to slender pointed wings was combined with the nonlinear steady lift coefficient. The result of both methods show that within the range of applicability of theories the damping derivatives increase with growing angle of attack, in other words, the increase in angle of attack has a stabilizing effect. Author (ESA)

N77-29168# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abt. Flugmechanik der Flaechenflugzeuge.
CALCULATION OF THE DYNAMIC RESPONSE OF CCV-TYPE AIRCRAFT Ph.D. Thesis
Bernd Krag 14 Dec. 1976 86 p refs In GERMAN; ENGLISH summary
(DLR-FB-76-78) Avail: NTIS HC A05/MF A01; DFVLR, Cologne DM 38.60

The lateral motion of a flexible aircraft with a T-tail was investigated. The aeroelastic oscillations of the T-tail were damped by a control system without adversely affecting the rigid body motion. Modal control theory and an extended root-locus method were used to design the control system. The developed methods were used to make an example calculation with HFB-320 aircraft. Author (ESA)

N77-29169# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
GUST LOAD ALLEVIATION CONTROL SYSTEMS: A FEASIBILITY STUDY
D. McLean 1976 182 p refs
(TT-7606) Avail: NTIS HC A09/MF A01

The feasibility of determining if it is possible to produce a satisfactory method of designing an automatic flight control system, for the specific purpose of alleviating the load effects on the response of the aircraft when it encounters atmospheric turbulence is discussed. The likely benefits resulting from active control technology are considered and gust alleviation systems are reviewed. Development of mathematical models for the representation of the dynamics of a flexible aircraft and its control as well as atmospheric turbulence is discussed. ESA

N77-29170# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
POLE-PLACEMENT METHODS. A SURVEY OF APPLICABLE METHODS FOR FLIGHT CONTROL SYSTEMS
D. McLean Oct. 1976 64 p refs
(TT-7607) Avail: NTIS HC A04/MF A01

Effective methods of pole-placement, a technique of linear systems theory which is useful in the design of flight control systems are discussed. The methods were collected from a range of publications and are illustrated by examples. A digital computer program, which evaluates the parameters of the compensation networks is also given. Author (ESA)

N77-29066*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE EFFECT OF COWLING SHAPE ON THE STABILITY CHARACTERISTICS OF AN AIRPLANE, SEPTEMBER 1942
Charles J. Donlan and W. Letko *In its* Collected Works of Charles J. Donlan [1976] 21 p refs (For primary document see N77-29059 20-01)
(L-343) Avail: NTIS HC A99/MF A01 CSCL 01C

N77-29067*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SOME THEORETICAL CONSIDERATIONS OF LONGITUDINAL STABILITY IN POWER-ON FLIGHT WITH SPECIAL REFERENCE TO WIND-TUNNEL TESTING, NOVEMBER 1942
Charles J. Donlan *In its* Collected Works of Charles J. Donlan [1976] 25 p refs (For primary document see N77-29059 20-01)
(L-309) Avail: NTIS HC A99/MF A01 CSCL 01C

N77-29070*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE STABILITY AND CONTROL OF TAILLESS AIRPLANES, 19 AUGUST 1944 Interim Report
Charles J. Donlan, comp. *In its* Collected Works of Charles J. Donlan [1976] 16 p refs (For primary document see N77-29059 20-01)
(Rept-796) Avail: NTIS HC A99/MF A01 CSCL 01C

N77-29072*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CURRENT STATUS OF LONGITUDINAL STABILITY, 24 MAY 1948
Charles J. Donlan *In its* Collected Works of Charles J. Donlan [1976] 17 p refs (For primary document see N77-29059 20-01)
(L8A28) Avail: NTIS HC A99/MF A01 CSCL 01C

N77-29073*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FACTORS AFFECTING STATIC LONGITUDINAL STABILITY AND CONTROL
Charles J. Donlan *In its* Collected Works of Charles J. Donlan [1976] 16 p refs (For primary document see N77-29059 20-01)
Avail: NTIS HC A99/MF A01 CSCL 01C

N77-29076*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SOME EFFECTS OF SWEEPBACK AND AIRFOIL THICKNESS ON LONGITUDINAL STABILITY AND CONTROL CHARACTERISTICS AT TRANSONIC SPEEDS
Charles J. Donlan and Arva A. Luoma *In its* Collected Works of Charles J. Donlan [1976] 12 p refs (For primary document see N77-29059 20-01)
Avail: NTIS HC A99/MF A01 CSCL 01C

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N77-29171# Committee on Government Operations (U. S. House).
FAA PROCEDURES IN MAKING NO HAZARD DETERMINATIONS WITH RESPECT TO STRUCTURES NEAR AIRPORTS
Washington GPO 1976 60 p Hearing before a subcomm. of Comm. on Govt. Operations, 94th Congr., 2d Sess., 10 Sep. 1976
(GPO-79-322) Avail: Comm. on Govt. Operations

The process of appoving construction of potentially hazardous structures near an airport is examined; the local environmental effects and community involvement are considered. This hearing focuses on the construction of a radio antenna tower in the vicinity of the Rochester-Monroe County Airport in New York.
J.H.

N77-29172*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL AND ANALYTICAL DYNAMIC FLOW CHARACTERISTICS OF AN AXIAL-FLOW FAN FROM AN AIR CUSHION LANDING SYSTEM MODEL
William C. Thompson, Ashok B. Boghani (Foster-Miller Assoc., Inc.), and Trafford J. W. Leland Washington Jul. 1977 49 p refs
(NASA-TN-D-8413; L-11154) Avail: NTIS HC A03/MF A01 CSCL 21H

An investigation was conducted to compare the steady-state and dynamic flow characteristics of an axial-flow fan which had been used previously as the air supply fan for some model air cushion landing system studies. Steady-state flow characteristics were determined in the standard manner by using differential orifice pressures for the flow regime from free flow to zero flow. In this same regime, a correlative technique was established so that fan inlet and outlet pressures could be used to measure dynamic flow as created by a rotating damper. Dynamic tests at damper frequencies up to 5 Hz showed very different flow characteristics when compared with steady-state flow, particularly with respect to peak pressures and the pressure-flow relationship at fan stall and unstall. A generalized, rational mathematical fan model was developed based on physical fan parameters and a steady-state flow characteristic. The model showed good correlation with experimental tests at damper frequencies up to 5 Hz.
Author

N77-29173*# Computer Sciences Corp., Mountain View, Calif.
SIMULATION OF A SYNERGISTIC SIX-POST MOTION SYSTEM ON THE FLIGHT SIMULATOR FOR ADVANCED AIRCRAFT AT NASA-AMES
Samiresh C. Bose and Benton L. Parris Jul. 1977 44 p refs (Contract NAS2-7806)
(NASA-CR-152010) Avail: NTIS HC A03/MF A01 CSCL 14B

Motion system drive philosophy and corresponding real-time software have been developed for the purpose of simulating the characteristics of a typical synergistic Six-Post Motion System (SPMS) on the Flight Simulator for Advanced Aircraft (FSAA) at NASA-Ames which is a non-synergistic motion system. This paper gives a brief description of these two types of motion systems and the general methods of producing motion cues of the FSAA. An actuator extension transformation which allows the simulation of a typical SPMS by appropriate drive washout and variable position limiting is described.
Author

N77-29174# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Soils and Pavements Lab.
STRUCTURAL DESIGN OF PAVEMENTS FOR LIGHT AIRCRAFT Final Report, Jan. 1975 - May 1976
Donald M. Ladd, Frazier Parker, Jr., and A. Traboza Pereira Dec. 1976 79 p refs
(Contract DOT-FA75WAI-526)
(AD-A041300; FAA-RD-76-179) Avail: NTIS HC A05/MF A01 CSCL 01/5

Structural design criteria for airfield pavements to be used by light aircraft were studied. Criteria for conventional flexible and rigid pavements, for rigid and flexible pavements containing stabilized layers and membrane encapsulated soil layers, and for unsurfaced areas are presented. A cost benefit analysis and a construction guide for thin concrete pavements are outlined.
Author

N77-29175# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
PLASTIC PIPE IN AIRPORT DRAINAGE SYSTEM, PHASE 2 Interim Report, May - Sep. 1976
Gary G. Harvey Jan. 1977 83 p refs
(Contract DOT-FA75WAI-536)
(AD-A041200; FAA-RD-77-38) Avail: NTIS HC A05/MF A01 CSCL 01/5

The types of plastic pipe chosen for recommended use are: (a) polyethylene (PE), (b) polyvinyl chloride (PVC), and (c) acrylonitrile-butadienestyrene (ABS). The products dealt with are perforated corrugated PE tubing and perforated smooth-wall PVC pipe for underdrains; and unperforated smooth-wall PVC and ABS composite pipe for storm drains, collector drains, and small culverts. Available plastic pipe products were evaluated for their potential performance in airport drainage applications. The evaluation considered such factors as pipe strength, soil-structure interaction, chemical and ultraviolet radiation resistance, abrasion resistance, and resistance to biological attack.
Author

N77-29176# Aerospace Systems, Inc., Burlington, Mass.
REPORT ON AIRPORT CAPACITY: LARGE HUB AIRPORTS IN THE UNITED STATES Final Report
Daniel E. Gentry, Jack D. Howell, and Nawal K. Taneja May 1977 873 p refs
(AD-A041435; FAA-AVP-77-26) Avail: NTIS HC A99/MF A01 CSCL 01/5

An airport capacity analysis recently completed for the large hub airports of the United States is decribed. Information was collected on existing and planned airport capacities and facilities for the airport, terminal, and landside components, as well as on ticket counters, curb frontages, baggage claim devices, security checkpoints, parking, gates, and runways. The study motivation, data sought, survey methodology, and data sources are also considered. Author

N77-29177# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.
HYDRAULIC TEST RIG FOR OSCILLATING WIND TUNNEL MODELS
R. Poestkoke 15 Aug. 1976 19 p Presented at the 46th Semiann. Meeting of the Supersonic Tunnel Assoc., Columbus, Ohio, 30 Sep. -1 Oct. 1976
(NLR-MP-76020-U) Avail: NTIS HC A02/MF A01

A test setup allowing oscillatory pitch motions of wind tunnel models for the measurement of unsteady aerodynamic loads is described. The mean angle of attack, as well as the time dependent variation in angle of attack, are controlled by a single hydraulic actuator. The test rig was designed in such a way that flow phenomena around the model can be visualized. The motions of the model are not limited to sinusoidal displacements; other types of time histories can also be generated.
Author (ESA)

N77-29178# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
FLIGHT MECHANICS AND PROGRAMMING OF A FLIGHT SIMULATOR EXEMPLIFIED FOR THE HPB 320 [FLUGMECHANIK UND PROGRAMMIERUNG EINES FLUGSIMULATORS AM BEISPIEL DER HPB 320]
Klaus-Peter Holzhausen and Peter Kuehne Dec. 1974 210 p refs In GERMAN; ENGLISH summary
(FB-19) Avail: NTIS HC A10/MF A01; Forschungsinst. fuer Anthropotech., Meckenheim, West Ger. DM 10

The flight mechanics and programs of a fixed-base research flight simulator without visual simulation are described. The simulated aircraft type is the HFB 320 Hansa jet, a twin engined business jet. Flight simulation mathematical models with general applicability were developed and then simplified in such a way that they would have realistic Hansa jet landing characteristics while still being suitable for a small digital computer. The total model including engine and landing gear and scale factors derived from data supplied from the manufacturer is presented together with a program flowchart in a readily usable form. Also given is a comparison of simulated flight characteristics with those of the real aircraft. Author (ESA)

N77-29179# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
METHODS OF NOISE SIMULATION AND THEIR APPLICATION TO FLIGHT SIMULATORS [METHODEN DER GERAEUSCHSIMULATION UND IHRE ANWENDUNG IN FLUGSIMULATOREN]
K.-P. Gaertner and K. Hillmann Apr. 1975 110 p refs In GERMAN; ENGLISH summary
(FB-22) Avail: NTIS HC A06/MF A01; Forschungsinst. fuer Anthropotech., Meckenheim, West Ger. DM 10

A survey of methods for electronically synthesizing sounds is presented. A given amount of hardware and computer capacity places an upper limit on the degree and fidelity of realism of sound simulation which is attainable. Good sound realism for aircraft simulators can be especially expensive because of the complexity of flight sounds and their changing patterns through time. The flight simulator described shows that it is possible to design an inexpensive sound simulator with the required acoustic properties using analog computer elements. The characteristics of the sub-sound elements produced by this sound simulator for take-off, cruise, and approach are discussed. Author (ESA)

N77-29180# Naval Postgraduate School, Monterey, Calif.
AVIATION COMMON GROUND SUPPORT EQUIPMENT REPLACEMENT POLICY INVESTIGATION M.S. Thesis
Ronald Gilbert Patterson and Fred H. Bardley, Jr. Mar. 1977 65 p refs
(AD-A039160) Avail: NTIS HC A04/MF A01 CSCL 05/1

A detailed examination of the existing Naval Air Systems Command Common Ground Support Equipment replacement model is presented. Basic existing equipment replacement models are discussed and the Annual Cost Model is selected as being most applicable to Navy needs. Model inputs, consisting of both empirical data and assumptions are critically examined to determine the reasons for the observed limited program utility. Several areas for future research are also suggested to improve the program viability. Author (GRA)

N77-29181# Systems Research Labs., Inc., Dayton, Ohio.
AIRCRAFT SIMULATOR DATA REQUIREMENTS STUDY. VOLUME 1: EXECUTIVE SUMMARY Final Report, 1 May 1976 - 30 Jan. 1977
George A. Whiteside Jan. 1977 18 p
(Contract F33615-76-C-0106)
(AD-A040955; SRL-3298-Vol-1; ASD-TR-77-25-Vol-1) Avail: NTIS HC A02/MF A01 CSCL 01/3

In view of the increasing importance of modern digital computer-driven flight simulators in providing the required training, both for initial qualification and for the maintenance of readiness, it was determined that an up-to-date standard to identify the data required by simulator manufactures was needed. This standard would then be included in the development and acquisition contracts for future weapon systems to provide for the timely supply of the requisite data. GRA

N77-29182# Systems Research Labs., Inc., Dayton, Ohio.
AIRCRAFT SIMULATOR DATA REQUIREMENTS STUDY, VOLUME 3 Final Report
George A. Whiteside and Harold L. Iffland Jan. 1977 38 p
(Contract F33615-76-C-0106)
(AD-A040928; SRL-3298-Vol-3; ASD-TR-77-25-Vol-3) Avail: NTIS HC A03/MF A01 CSCL 01/3

This specification establishes the requirements for the preparation of aircraft design data for use in the design of aircraft training devices. The configuration data supplied herein will be used to fabricate and assemble crew stations which are physically equivalent to those used in the aircraft. The performance data will be used to develop transfer functions which will be programmed on a computer to accept inputs from pilot and crew stations and generate outputs to activate instruments, displays, indicators, etc. in a realistic manner. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N77-29183*# Science Applications, Inc., Huntsville, Ala.
OPTIMUM SPACE SHUTTLE LAUNCH TIMES RELATIVE TO NATURAL ENVIRONMENT Final Report
R. L. King 15 Apr. 1977 385 p ref
(Contract NAS8-31798)
(NASA-CR-150354; SAI-77-785-HU) Avail: NTIS HC A17/MF A01 CSCL 22A

The probabilities of favorable and unfavorable weather conditions for launch and landing of the STS under different criteria were computed for every three hours on a yearly basis using 14 years of weather data. These temporal probability distributions were considered for three sets of weather criteria encompassing benign, moderate and severe weather conditions for both Kennedy Space Center and for Edwards Air Force Base. In addition, the conditional probabilities were computed for unfavorable weather conditions occurring after a delay which may or may not be due to weather conditions. Also for KSC, the probabilities of favorable landing conditions at various times after favorable launch conditions have prevailed. The probabilities were computed to indicate the significance of each weather element to the overall result. Author

N77-29184*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OPPORTUNITIES FOR BALLISTIC MISSIONS TO HALLEY'S COMET
Robert W. Farquhar and William H. Wooden, II Washington

Aug. 1977 42 p refs
(NASA-TN-D-8453; G7702-F-17) Avail: NTIS HC A03/MF A01 CSCL 22A

Alternative strategies for ballistic missions to Halley's comet in 1985-86 are described. A large scientific return would be acquired from a ballistic Halley intercept in spite of the high flyby speeds that are associated with this mission mode. The possibility of retargeting the cometary spacecraft to additional comets after the Halley intercept also exists. Two cometary spacecraft of identical design would be used to carry out four separate cometary encounters over a 3 year period. One spacecraft would intercept Halley's comet before its perihelion passage in December 1985 and then go on to comet Borrelly with an encounter in January 1988. The other spacecraft would be targeted for a postperihelion Halley intercept in March 1986 before proceeding toward an encounter with comet Tempel 2 in September 1988. Author

N77-29185# Centre National de la Recherche Scientifique, Marseilles (France). Lab. d'Astronomie Spatiale.
PROPOSALS FOR SPACE RESEARCH IN 1977 [PROPOSITIONS DE RECHERCHE SPATIALE POUR 1977]
Mar. 1976 114 p refs In FRENCH
(LAS-PG-76-01) Avail: NTIS HC A06/MF A01

Proposals include the astronomical satellite D2B AURA, the program Skylab S183, the program Faust, projects of French and Soviet international collaboration, balloon sounding experiments, widefield spectrophotometry of the interstellar medium (groundbased experiments), and TV by photon counting. Some research projects not sponsored by CNES are also included. Cost of the abovementioned projects for 1977 is tabulated. ESA

N77-29186# Centre National de la Recherche Scientifique, Marseilles (France). Lab. d'Astronomie Spatiale.
SPACELAB PROPOSAL: WIDE FIELD SPECTROPHOTOMETRY [PROPOSITION SPACELAB. SPECTROPHOTOMETRE A GRAND CHAMP]
14 Apr. 1975 51 p In FRENCH
(LAS-CGC-02/75) Avail: NTIS HC A04/MF A01

The program proposed for UV and IR galactic and extragalactic media observations onboard Spacelab includes the large field spectrophotometer for the survey of continuum and the large stellar clouds of the Galaxy, the choice of optical system, Spacelab interfaces including Spacelab superior airlock characteristics, mechanical and electrical interfaces, orbital and attitude parameters, the procedure for use of the spectrophotometer by the astronaut, realization planning, and the budget. ESA

N77-29080*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PROJECT MERCURY: THE PROGRAM AND ITS OBJECTIVES
Charles J. Donlan and Jack C. Heberlig *In its* Collected Works of Charles J. Donlan [1976] 26 p refs Presented at Symp. on Psychophysiolog. Aspects of Space Flight, San Antonio, Tex., 26-27 May 1960 (For primary document see N77-29059 20-01)
Avail: NTIS HC A99/MF A01 CSCL 22A

N77-29081*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
GUIDELINES FOR ADVANCED MANNED SPACE VEHICLE PROGRAM, JUNE 1960
Robert R. Gilruth, Robert O. Piland, Mayime A. Faget, Stanley C. White, Robert C. Chilton, and Charles J. Donlan *In its* Collected Works of Charles J. Donlan [1976] 66 p refs (For primary document see N77-29059 20-01)
Avail: NTIS HC A99/MF A01 CSCL 22A

N77-29083*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PROGRESS REPORT ON PROJECT MERCURY
Charles J. Donlan and Jack C. Heberlig *In its* Collected Works of Charles J. Donlan [1976] 6 p Repr. from Astronautics, Aug. 1960 p 32-33, 73-76 (For primary document see N77-29059 20-01)
Avail: NTIS HC A99/MF A01 CSCL 22A

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N77-29187# Sandia Labs., Albuquerque, N. Mex. Aeroballistics Projects Div.
AUTOMATED SCHEME TO DETERMINE DESIGN PARAMETERS FOR A RECOVERABLE REENTRY VEHICLE
Walton E. Williamson, Jr. Dec. 1976 31 p refs
(Contract EY-76-C-04-0789)
(SAND-76-0678) Avail: NTIS HC A03/MF A01

The NRV (Nosetip Recovery Vehicle) program is designed to recover the nose section from a sphere cone reentry vehicle after it has flown a near ICBM reentry trajectory. Both mass jettison and parachutes are used to reduce the velocity of the RV near the end of the trajectory to a sufficiently low level that the vehicle may land intact. The design problem of determining mass jettison time and parachute deployment time in order to ensure that the vehicle does land intact is considered. The problem is formulated as a min-max optimization problem where the design parameters are selected to minimize the maximum possible deviation in the design criteria due to uncertainties in the system. The results indicate that the optimal choice of the design parameters ensures that the maximum deviation in the design criteria is within acceptable bounds, and analytically ensures the feasibility of recovery for NRV. ERA

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air).*

N77-29188# California Univ., Livermore. Lawrence Livermore Lab.
COMPUTER-CONTROLLED MULTIPLE-ACTUATOR SHAKER OFFERS VERSATILE TEST CAPABILITIES
D. K. Fisher 20 Jan. 1977 13 p refs
(Contract W-7405-eng-48)
(UCID-17347) Avail: NTIS HC A02/MF A01

A multiple-actuator shaker facility, is being used for such studies as shock and vibration tests of rocket motors, seismic qualification of a turbine-generator set, and performance analysis of the rock bolts used in mine-tunnel construction. Capabilities include the safe testing of hazardous materials and explosives. The computerized control system permits the shaker to be easily adapted to nonstandard shock and vibration tests. ERA

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N77-29189*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SKYLAB, CLASSROOM IN SPACE
Lee B. Summerlin, ed. Washington 1977 190 p Original contains color illustrations
(NASA-SP-401; LC-76-30715) Avail: NTIS MF A01; HC SOD CSCL 22A

Student-designed Skylab experiments are described and the results reported. Demonstrations performed on Skylab to show the effect of weightlessness are described. Author

N77-29190*# Atlantic Science Corp., Indialantic, Fla.
GRAVSAT/GEOPAUSE REFRACTION STUDY

S. K. Llewellyn et al Washington Aug. 1977 63 p refs (Contract NAS5-20744)
(NASA-CR-2891) Avail: NTIS HC A04/MF A01 CSCL 22D

A ground station network tracked a high altitude spacecraft which in turn tracked a low orbiting satellite. Orbit data are relayed back to the ground stations. A refraction study was performed on this configuration to compute ionospheric and tropospheric refraction effects along the satellite and ground links. Author

N77-29191# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.

MATHEMATICAL MODEL FOR ASCENT TRAJECTORY OPTIMIZATION OF A 4-STAGE LAUNCH VEHICLE FOR GEOSYNCHRONOUS MISSIONS [DAS MATHEMATISCHE MODELL ZUR AUFSTIEGSBAHNOPTIMIERUNG EINES 4-STUFIGEN TRAEGERS BEI SYNCHRONBAHNMISSIONEN]

W. Duffek and G. C. Schau 26 Feb. 1976 41 p refs In GERMAN Report will also be announced as translation (ESA-TT-409)
(DLR-IB-552-73/4) Avail: NTIS HC A03/MF A01

An extensive derivation of the mathematical relations in the optimization of the ascent trajectory is presented. The three-dimensional equations of motions were derived. An approximative representation was made of the Mach number dependence of the aerodynamic coefficients, as well as of the altitude dependency of the air density. Optimality conditions for the ejection of the payload shrouds were determined. The boundary conditions of the orbital transfer problem in the case of a pulsed thrust phase of the fourth stage were examined. ESA

N77-29192# National Aerospace Lab., Amsterdam (Netherlands). Scientific Services.

ESTIMATION OF MODELLING ERRORS IN SATELLITE ATTITUDE DETERMINATION

C. R. Traas 7 Jul. 1976 11 p refs Presented at the 27th AIAA/IAF Intern. Astronautical Congr., Anaheim, Calif., 10-16 Oct. 1976 Sponsored partly by Neth. Agency for Aerospace Programs (NIVR)
(NLR-MP-76019-U) Avail: NTIS HC A02/MF A01

The possibility of applying sequential state and parameter estimation procedures in case of incorrectly modeled dynamic systems was investigated. Of major concern was the estimation of the modeling errors, as a step to improve the accuracy of the state estimates. The modeling errors are modeled as piece-wise continuous low-order polynomials, the coefficients of which are included in the estimated vector. An effective algorithm is introduced to detect the phenomenon of filter divergence. Once divergence of the filter has been established a feed-back is activated to adapt the filter to the new situation. The feasibility of this approach is demonstrated with the help of a few realistic model problems in the field of satellite attitude determination. Author (ESA)

N77-29193# Centre National d'Etudes Spatiales, Toulouse (France).

ORBITAL POSITIONING OF THE SYMPHONIE SATELLITES. DESCRIPTION OF THE THIRD OPTIMIZATION LEVEL [MISE A POSTE DE SYMPHONIE - DESCRIPTION DU TROISIEME NIVEAU D'OPTIMISATION]

Alain Perret Dec. 1976 14 p refs In FRENCH; ENGLISH summary
(CNES-NT-64) Avail: NTIS HC A02/MF A01

The placing in orbit of the Symphonie geostationary satellites is described; a computer program for the optimization of operations was developed. This study aims at an operating result. The computer program is used before each maneuver and takes into consideration not only mistakes in previous maneuvers but also possible errors in subsequent maneuvers. The computer program is divided into three parts which may operate independently and which perform: the sorting out of possible procedures, the optimization of the apogee maneuver, and the optimization of subsequent maneuvers. Author (ESA)

N77-29194# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Angewandte Gasdynamik.

SOME INVESTIGATIONS OF MISSILES USING A SPIKE FOR AERODYNAMIC CONTROL AT HIGH MACH NUMBERS

Wolfgang Wyborny 3 Feb. 1977 31 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-410)
(DLR-FB-77-03) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 15

Missiles of a length of 7.5 calibers with stabilizing tail surfaces and different nose shapes were tested in a gun tunnel at Mach 8.8. The main purpose was to investigate the possibility of aerodynamic control by means of the spike deflection of such missiles. The order of magnitude of the maximum normal force for different nose shapes created by a deflected spike are calculated. Author (ESA)

N77-29195# Holmes-Siedle (Andrew), Oxford (England).

STUDY OF RADIATION SHIELDING REQUIREMENTS FOR N-MOS DEVICES ON THE EXOSAT SPACECRAFT Final Report

20 Feb. 1977 29 p
(Contract ESA-2945/76-AB)
(AHS-EXO-77-1; ESA-CR(P)-926) Avail: NTIS HC A03/MF A01

The device-degradation and radiation-shielding problems presented by the probable use of an n-channel microprocessor integrated circuit of the 8080 type on the Exosat spacecraft of the European Space Agency, was studied. The radiation exposure likely for this device was calculated, using various assumptions for the amount of surrounding absorber, some being intentional shielding others being normal structure elements and device encapsulation. The conclusion was that this type of device could be used if careful engineering design and quality control were used. Mission doses vary between 5000 and 800 rads for various configurations and some patterns of MOS device will tolerate these doses. The use of specially thickened module covers was not recommended, a better method being upgrading device quality and applying internal (local) shielding when necessary and possibly modular addition of external plates in specific directions only. The result of this shielding philosophy would be much greater efficiency in weight use. The further development of a rads (reduction) per gram philosophy was strongly recommended. Throughout, the strong link between mission success and the choice (and control) of the correct MOS manufacturing technology is emphasized and some guidelines on control of manufactured MOS parts (n-channel and complementary type) with respect to tolerance to radiation are given. Author (ESA)

N77-29196# Engins Matra, Velizy (France).

STUDY OF ATTITUDE CONTROL OF PROLATE SATELLITES IN TRANSFER ORBIT: THREE-AXIS STABILISATION Final Report

M. DoMauLam, R. Etienne, and J. L. Lacombe 28 Feb. 1977 248 p
(Contract ESTEC-2953/76-NL-PP(SC))
(Rept-115-01; ESA-CR(P)-928) Avail: NTIS HC A11/MF A01

Different concepts of active 3-axis stabilization of satellites on a geostationary transfer orbit are considered, including the apogee boost phase. The concepts are chosen in function of the solar arrays and antenna configurations, and are applicable to a liquid apogee boost motor case. Included are: the identification of constraints, the derivation of attitude control requirements, comparison of overall configurations, attitude control concepts, and a more detailed investigation of some typical AOCS approaches. A cost estimate of the AOCS approaches is given. Author (ESA)

N77-29197# British Airports Authority, London (England). Electronics and Space Systems Group.

ATTITUDE CONTROL OF PROLATE SATELLITES IN TRANSFER ORBIT Final Report

C. Milburn, D. Smart, T. Morley, L. Virdee, and J. K. Ratcliffe Mar. 1977 148 p refs
(Contract ESTEC-2952/76)
(ESA/SS-781; ESA-CR(P)-934) Avail: NTIS HC A07/MF A01

The stabilization is considered of spinning prolate satellites

during a geosynchronous transfer orbit and in particular for satellites carrying a liquid fuel apogee boost motor. Two fundamentally different approaches were taken. The first concept is one which employs spin rates of less than 1 rpm with the aim of reducing the magnitude of the well known dynamic instability of a prolate body in the presence of internal energy dissipation. The second concept is the use of a conventional active nutation control system on such a satellite, the aim being to assess the performance and limits of acceptability of such a control system. Analysis of all phases of the transfer orbit, from separation of the launch vehicle to geosynchronous injection, was undertaken in a parametric manner, the magnitude of energy dissipation within the satellite being the main variable. Results indicate that in all cases the apogee motor firing is the critical phase of the transfer orbit since for a liquid fuel apogee motor the jet damping is very low whilst parasitic torque due to thrust vector misalignment can cause large injection errors at low satellite spin rates. As a result of this it is concluded that a spin rate of at least 5 rpm should be adopted and that a nutation control system should be employed using thrusters for nutation control and a gyroscope to sense the nutational motions. This system must also be in operation during the apogee motor firing.

Author (ESA)

N77-29198# British Airports Authority, London (England). Electronics and Space Systems Group.

ATTITUDE CONTROL OF THREE-AXES STABILISED SPACECRAFT WITH FLEXIBLE APPENDAGES, VOLUME 1 Final Report

R. S. Harris, D. C. Todman, M. J. Hammond, and R. J. Annett Apr. 1977 390 p refs 2 Vol.
(Contract ESTEC-2312/74)
(ESA/SS-783-Vol-1; ESA-CR(P)-945-Vol-1) Avail: NTIS HC A17/MF A01

An investigation into the flexure-satellite attitude spacecraft interaction due to two uniform beam arrays on a three axis stabilized is reported. An extension is made to the parametric study to determine the applicability of a control scheme, designed neglecting flexure, to a reaction wheel stabilized flexible satellite. Charts are derived which show stability boundaries and attitude response magnitudes to a torque impulse. These provide a quantitative indication as to the extent of flexure interaction over a wide parameter range. The definition is extended of an observer-based control law designed, for the reaction wheel stabilized satellite, to reduce flexure interaction. The control scheme provides both attitude stabilization and active damping of the structural oscillations. It is optimized on the criteria of minimizing sensor noise effects whilst keeping the sensitivity to uncertainties in the system parameters low. The capability of providing active flexure damping, by optimizing the parameters of the DGMW gimbal servo loops is investigated. The servo loop structure was modified in order to improve the response to initial conditions which saturate the gimbal torquer. A similar analysis is performed for an SGMW system with both linear and stepper motor actuators and the flexure mode damping of the three systems is compared. The implementation of an in-orbit test program to identify the main structural parameters and to evaluate the control system performance of an SGMW and an FMW stabilized flexible satellite is investigated. The analysis and trade-off of sensor arrangements, excitation techniques, and data processing methods are presented. Author (ESA)

N77-29199# British Airports Authority, London (England). Electronics and Space Systems Group.

ATTITUDE CONTROL OF THREE-AXES STABILISED SPACECRAFT WITH FLEXIBLE APPENDAGES, VOLUME 2 Final Report

R. S. Harris, D. C. Todman, M. J. Hammond, and R. J. Annett Apr. 1977 240 p 2 Vol.
(Contract ESTEC-2312/74)
(ESS/SS-783-Vol-2; ESA-CR(P)-945-Vol-2) Avail: NTIS HC A11/MF A01

Computation, details, computer listings, graphs, and tables are presented for the investigation into flexure-satellite attitude interaction due to two uniform beam arrays on a three axis stabilized spacecraft. ESA

N77-29200# Naval Weapons Center, China Lake, Calif.

CALCULATION OF EFFECTIVE OZONE ABSORPTION FOR A ROCKETBORNE OZONESONDE Final Report

Marian E. Hills and Czerna A. Flanagan Mar. 1977 44 p
(AD-A038726; NWC-TP-5904) Avail: NTIS HC A03/MF A01 CSCL 04/1

The measurement of the transmittance of filters used in a rocketborne ozonesonde and the calculation of effective ozone absorption coefficients from the transmittance data are described. Author (GRA)

N77-29201# Analytical Systems Engineering Corp., Burlington, Mass.

ELECTRONIC RADIATION IN THE VICINITY OF SYNCHRONOUS ORBIT SATELLITES: LITERATURE SURVEY

George A. Bakalyar 18 Jan. 1977 33 p refs
(Contract F19628-76-C-0203)
(AD-A038805; AFGL-TR-77-0024; Scientific-1) Avail: NTIS HC A03/MF A01 CSCL 20/9

A categorized list of representative references are presented that apply to the task of estimating and predicting undesirable radiation incident to a satellite in synchronous orbit. The categories of references address basic elements of the task. That is, some references apply to estimating the particle and field environment about the satellite and other references are relevant to estimating the behavior of the medium, either as supporting of electrical discharge or the excitation of radiation through instability and/or the presence of plasma boundaries. Both theoretical and experimental references are included in each category where possible. The breakdown of Plasma, which is a 'necessary' condition to the generation of discharge currents in plasma, is a much studied phenomenon both theoretically and experimentally. The references 6a of this report, together with the bibliographies associated with each reference, provide a representative information base to support either a critical review of important elements of breakdown and electrical discharge literature from about 1960 to the present time, or an ordered resume of breakdown characteristics as determined in that time period.

Author (GRA)

N77-29202# Naval Surface Weapons Center, Dahlgren, Va.

A SATELLITE RADAR ALTIMETRY DATA ANALYSIS COMPUTER PROGRAM FOR GEODETIC APPLICATIONS

Henry E. Castro Apr. 1977 91 p refs
(AD-A039150; NSWC/DL-TR-3647) Avail: NTIS HC A05/MF A01 CSCL 09/2

The information given in this maintenance manual contains a description of a computer program used to study the feasibility of the Wiener-Kolmogoroff filter as applied to satellite radar altimetry data at sea. Useful radar signal data is imbedded in noise which has to be filtered in order to recover deflections of the vertical and geoid heights. Also included, is the definition of program variables, macro-flowcharts, an Extended FORTRAN IV listing, sample input/output, and some of the program operational characteristics. Author (GRA)

N77-29203# Linkabit Corp., San Diego, Calif.

RESEARCH IN INFORMATION THEORY Final Report, 12 Apr. 1976 - 11 Apr. 1977

J. P. M. Schalkwijk, K. A. Post, and A. J. Vinck 9 May 1977 85 p refs
(Contract N00123-76-C-0842)
(AD-A039243; Rept-6148-A002) Avail: NTIS HC A05/MF A01 CSCL 09/4

This paper concerns a state space approach to syndrome decoding of binary rate-k/n convolutional codes. State space symmetries of a certain class of codes can be exploited to obtain an exponential reduction of decoder hardware. Aside from these hardware savings, it is felt that the state space formalism developed in this report has some intrinsic value of its own.

Author (GRA)

N77-29204# Alabama Univ., University. Bureau of Engineering Research.

OPTIMAL GUIDANCE FOR MODULAR WEAPONS WITH DIGITAL AUTOPILOTS Final Report, 1 May - 31 Dec. 1977

John N. Youngblood Apr. 1977 51 p refs

(Grant AF-AFOSR-3008-76)
(AD-A040449; BER-212-09; AFOSR-77-0691TR) Avail: NTIS HC A04/MF A01 CSCL 17/7

The optimal linear quadratic guidance problem with an accelerating target is investigated. The missile state is partitioned into a kinematic state and an airframe state. Both the penalty-weighted and constained terminal state cases are treated. The resulting optimal guidance law requires estimates of target accelerations which are derived via linear observers. Results of a point mass missile, a one-time constant missile, and a two-time constant missile are given. Author (GRA)

N77-29205# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
THE APL MAGSAT ATTITUDE TRANSFER SYSTEM CONCEPT
Fred W. Schenkel and Abraham Finkel Apr. 1977 52 p
(Contract N00017-72-C-4401)
(AD-A040987; APL/JHU-CP-055) Avail: NTIS HC A04/MF A01 CSCL 17/7

This document describes the conceptual design and analysis for an Attitude Transfer System (ATS) to perform continuous measurement of the three-axis attitude of a vector magnetometer experiment, relative to a pair of star sensors fastened to a satellite body. The magnetometer is suspended at the end of a 20-ft boom extending from the body of MAGSAT (a survey satellite for measurement of the earth's magnetic field). A common optical bench serves as the mounting reference for both the ATS and the star sensors. The directional accuracy of the vector magnetometer experiment is required to be 20 arc seconds in all three axes. An error allocation analysis has determined that the ATS must provide an accuracy of 7 arc seconds per axis to meet the overall system requirements. Author (GRA)

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

N77-29206*# Physical Dynamics, Inc., Berkeley, Calif.
RANGE SAFETY SIGNAL PROPAGATION THROUGH THE SRM EXHAUST PLUME OF THE SPACE SHUTTLE Final Report
Frederick P. Boynton, Alan R. Davies, P. S. Rajasekhar, and J. Alex Thompson May 1977 139 p refs
(Contract NAS8-32120)
(NASA-CR-150353; PD-B-77-141) Avail: NTIS HC A07/MF A01 CSCL 22D

Theoretical predictions of plume interference for the space shuttle range safety system by solid rocket booster exhaust plumes are reported. The signal propagation was calculated using a split operator technique based upon the Fresnel-Kirchoff integral, using fast Fourier transforms to evaluate the convolution and treating the plume as a series of absorbing and phase-changing screens. Talanov's lens transformation was applied to reduce aliasing problems caused by ray divergence. Author

N77-29207*# General Dynamics/Convair, San Diego, Calif.
SPACE SHUTTLE ORBITER REAR MOUNTED REACTION CONTROL SYSTEM JET INTERACTION STUDY Final Report
J. R. Rausch May 1977 451 p refs
(Contract NAS9-14095)
(NASA-CR-151487; CASD-NSC-77-003) Avail: NTIS HC A20/MF A01 CSCL 22B

The effect of interaction between the reaction control system (RCS) jets and the flow over the space shuttle orbiter in the atmosphere was investigated in the NASA Langley 31-inch continuous flow hypersonic tunnel at a nominal Mach number of 10.3 and in the AEDC continuous flow hypersonic tunnel B at a nominal Mach number of 6, using 0.01 and .0125 scale force models with aft RCS nozzles mounted both on the model and on the sting of the force model balance. The data show that RCS nozzle exit momentum ratio is the primary correlating parameter for effects where the plume impinges on an adjacent surface and mass flow ratio is the parameter when the plume interaction is primarily with the external stream. An analytic model of aft mounted RCS units was developed in which the total reaction control moments are the sum of thrust, impingement, interaction, and cross-coupling terms. Author

N77-29208*# McDonnell-Douglas Astronautics Co., Houston, Tex.
OPTIMIZATION OF THE SPACE SHUTTLE ENTRY GUIDANCE LATERAL DEADBAND, MINIMUM BANK ANGLE LOGIC
P. B. Bump 25 Jul. 1977 110 p refs
(Contract NAS9-14960)
(NASA-CR-151480; DN-1.4-4-30) Avail: NTIS HC A06/MF A01 CSCL 22A

The lateral deadband and minimum bank angle schedule were studied. Results used by the analytic drag control entry guidance system are presented. Lateral deadband limits and configuration were investigated and possible changes in the minimum bank angle schedule to improve crossrange control and drag acceleration control for entry were examined. The study recommends a 12.5 deg lateral deadband to accommodate low dispersions of up to 23%. Author

N77-29209*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERODYNAMIC CHARACTERISTICS OF TWO SINGLE-STAGE-TO-ORBIT VEHICLES AT MACH 20.3
Peter T. Bernot Washington Aug. 1977 36 p refs
(NASA-TM-X-3550; L-11627) Avail: NTIS HC A03/MF A01 CSCL 22B

The hypersonic stability, control, and performance characteristics of two configurations have been determined. Each configuration had a 50 deg swept delta wing, a vertical tail, and a body flap. One model represented a control configured vehicle with a reduced level of longitudinal static stability; the other model was designed for a conventional level of stability. Data were obtained over an angle of attack range of 0 deg to 50 deg and included effects of component buildup. In addition, the effects of the vertical tail on the lateral directional characteristics were obtained. Author

N77-29210# Technische Univ., Berlin (West Germany). Inst. fuer Luft- und Raumfahrt.
PROSPECTS: DESIGN OF A PROJECT PLAN FOR A REUSABLE CARRIER SYSTEM FOR HEAVY CARGO TRANSPORTATION IN SPACE [PROSPECTS. ENTWURF EINES PROJEKTPLANES FUER EIN WIEDERVERWENDBARES TRAEGERSYSTEM FUER SCHWERLAST-TRANSPORTE IN DEN WELTRAUM]
D. Bosin, D. Ehlers, I. Johannessen, D. Kassing, H. H. Koelle, A. Mielcarec, J. Petersen, R. Ress, and W. Westphal Jul. 1976 112 p refs In GERMAN; ENGLISH summary
(ILR-Mitt-33) Avail: NTIS HC A06/MF A01

The space project described concerns a reusable space transportation system (STS) for the transport of heavy cargo payloads in the order of 100 tons into geostationary orbit and energy equivalent space missions. It is intended to become the backbone of a global space program. This STS is expected to supplement the space shuttle STS and any remaining expendable carrier vehicles on or about 1990. The anticipated market situation for such a vehicle and the economical and political environment are considered in the form of two possible scenarios. Possible vehicle concept alternatives are indicated and typical selection criteria to arrive at the best possible configuration are listed. One of the possible configurations is selected for illustrative purposes and described in some detail with respect to dimensions, masses, performance, and cost. This description is complemented by a representative time, financial, and organizational plan. Potential benefits are evaluated and presented. Author (ESA)

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N77-29211# Pattern Analysis and Recognition Corp., Rome, N. Y.
REAL TIME ADAPTIVE TRACKING SYSTEM FOR THE COELOSTAT OPTICAL TRACKING MOUNT Final Technical Report, Jan. - Nov. 1976
Ranjan V. Sonalkar, Roger L. Dygert, and Probal K. Sanyal Feb. 1977 131 p refs
(Contract F30602-75-C-0144)
(AD-A038134; PAR-76-32; RADC-TR-77-67) Avail: NTIS HC A07/MF A01 CSCL 17/8

The overall system developed, consists of programs for tracking stars and satellites. The star tracking routine requires current values of right ascension and declination of the star to be tracked and may also be used for short time tracking of planets, if so desired. There are two separate systems for tracking satellites. In the absence of any satellite differential position measuring equipment, Simplified Generalized Perturbation theory is used to predict satellite position. Using NORAD satellite card parameters and a timing input, the program is sequenced to compute the satellite's direction and outputs these angles to the mount servo systems. In the second system a computer-TV interface was fabricated to measure the satellite differential position after obtaining it in the field of view. This measured position is fed back to the computer, which, in turn, uses that as observed error data for a Kalman filter. The filter calculates updated parameters while tracking the satellite position as a function of time. The report includes a detailed technical description, program documentation, and a system user's manual. GRA

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N77-29212 Stanford Univ., Calif.
SIMULATION OF ATTITUDE MOTIONS OF SPACECRAFT Ph.D. Thesis
Ronald Lee Roth 1976 161 p
Avail: Univ. Microfilms Order No. 77-7160

Equations of motion are derived for torque free, elastic, dissipative systems possessing a finite number of degrees of freedom. The equations are linearized about a particular solution in the variables describing the internal configuration of the system, and are then used to produce a computer program which permits the user to obtain information about motions of a given system without writing any computer code. The FORTRAN code for the program is listed in detail together with user instructions and two illustrative examples. Dissert. Abstr.

N77-29213*# Southwest Foundation for Research and Education, San Antonio, Tex.
EVALUATION OF PERFORMANCE IMPAIRMENT BY SPACECRAFT CONTAMINANTS Progress Report, 7 Jul. 1976 - 28 Feb. 1977
Irving Geller, Roy J. Hartman, Jr., and Victor M. Mendez 1977 71 p refs
(Contract NAS9-14743)
(NASA-CR-151478) Avail: NTIS HC A04/MF A01 CSCL 22B

The environmental contaminants (isolated as off-gases in Skylab and Apollo missions) were evaluated. Specifically, six contaminants were evaluated for their effects on the behavior of juvenile baboons. The concentrations of contaminants were determined through preliminary range-finding studies with laboratory rats. The contaminants evaluated were acetone, methyl ethyl ketone (MEK), methyl isobutyl ketone (MIBK), trichloroethylene (TCE), heptane and Freon 21. When the studies of the individual gases were completed, the baboons were also exposed to a mixture of MEK and TCE. The data obtained revealed alterations in the behavior of baboons exposed to relatively low levels of the contaminants. These findings were presented at the First International Symposium on Voluntary Inhalation of Industrial Solvents in Mexico City, June 21-24, 1976. A preprint of the proceedings is included. Author

N77-29214# European Space Agency, Paris (France).
DEGRADATION OF THERMAL CONTROL COATINGS BY ULTRAVIOLET AND PARTICLE IRRADIATION
A. Paillous Jun. 1977 194 p refs Transl. into ENGLISH of 'Degradation de Revetements de Controle Thermique par Irradiations Ultraviolettes et Particulaires', ONERA, Toulouse Report ONERA-DERTS-4047, Oct. 1976 Original report in FRENCH previously announced as N77-23415
(ESA-TT-388; ESA-CR(P)-913; ONERA-DERTS-4047) Avail: NTIS HC A09/MF A01

The degradation of the solar reflector factor was investigated for 10 types of thermal control coatings during a simulated 3-year exposure to the space environment of the geosynchronous OTS satellite. The irradiations and measurements were carried out under secondary vacuum conditions at 90 C. A simultaneous exposure to ultraviolet radiation, to 200 keV electrons, and to 40 and 150 keV protons was achieved. The materials tested were indium oxide conduction coatings, American and French zinc oxide white paints, and conduction black paints. The electrical resistance of the samples was recorded as a function of time. Author (ESA)

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N77-29215# Hawker Siddeley Dynamics Ltd., Stevenage (England). Space Div.
COMMON ATTITUDE POINTING SYSTEMS (CAPS), PHASE A STUDY. VOLUME 1: SUMMARY Final Report
J. B. Farrow, comp. Feb. 1977 61 p refs 2 Vol.
(Contract ESA-2859/76)
(HSD-TP-7619-Vol-1; ESA-CR(P)-930-Vol-1) Avail: NTIS HC A04/MF A01

Aspects of a Common Attitude Pointing System (CAPS) for Spacelab are considered. Experiment requirements (passive atmospheric sounders and microwave earth observations) were analyzed and compared with the orbiter pointing and stability capabilities. For the various experiments an assessment was made of the adequacy of: a simple mount relying entirely on the orbiter control system, a simplified CAPS design partly dependent on the orbiter control system, and an autonomous CAPS design. An extended CAPS analysis, trade-offs, and concept selection were performed. Systems and subsystems designs for a preferred concept were evolved, and accommodation and operation in Spacelab were investigated and defined. A development plan consistent with the first Spacelab payload was prepared and cost estimates are given. Critical cost/performance trade-offs items were identified, and critical design and development areas were assessed. ESA

N77-29216# Hawker Siddeley Dynamics Ltd., Stevenage (England). Space Div.
COMMON ATTITUDE POINTING SYSTEM (CAPS), PHASE A STUDY. VOLUME 2: TECHNICAL DETAILS Final Report

J. B. Farrow, comp. Feb. 1977 308 p refs 2 Vol.
(Contract ESA-2859/76)
(HSD-TP-7619-Vol-2; ESA-CR(P)-930-Vol-2) Avail: NTIS HC A14/MF A01
For abstract, see N77-29215.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N77-29217 Colorado State Univ., Fort Collins.
CUSPED MAGNETIC FIELD MERCURY ION THRUSTER Ph.D. Thesis
John Robert Beattie 1976 112 p
Avail: Univ. Microfilms Order No. 77-6794

The importance of a uniform current density profile in the exhaust beam of an electrostatic ion thruster is discussed in terms of thrust level and accelerator system lifetime. A residence time approach is used to explain the nonuniform beam current density profile the SERT II divergent magnetic field thruster and to propose a magnetic field modification (the cusped magnetic field geometry) which should produce a highly uniform beam profile. A discharge chamber model is proposed and mathematical expressions are derived which relate the thruster discharge power loss, propellant utilization, and double-to-single ion density ratio to the geometry and plasma properties of the discharge chamber. These relationships are applied to a cylindrical discharge chamber model of the SERT II thruster and suggest that, in addition to the magnetic field modification, the discharge chamber length of this thruster should be reduced. Dissert. Abstr.

N77-29218# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
SOLID PROPELLANT ROCKET ENGINES AND BALLOON SYSTEMS AS CARRIERS FOR TEST MISSILES [FESTSTOFFRAKETENTRIEBWERKE UND BALLONSYSTEME ALS VERSUCHSTRAEGER FUER MESSFLUGKOERPER]
H. Muelhaus Bonn DOKZENTBw 1976 34 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(BMVg-FBWT-76-21) Avail: NTIS HC A03/MF A01; DOKZENTBw, Bonn DM 20

Carrier systems for the transportation of parachute testing missiles were investigated and compared in regard to determination of scaling effects. The successful test'- ; of clustered power plants for the study of parachutes with 50 kg-parachute-testing missiles at low altitudes is described. Power plants with increased performance were defined for increased missile mass, and multistaged power plants were theoretically investigated for application at medium altitudes; however, because of the high energy demand for trajectories with a high apogee, the concept of the clustered arrangement of priceworthy, mass produced power plants is no longer possible. An alternative for this mission range is the use of balloon systems for the ascent, combined with aerodynamic control devices for the subsequent maneuver into level flight of the parachute-testing missile. Such a system was theoretically investigated and the technical procedure is described. Author (ESA)

N77-29219# Aerospace Corp., El Segundo, Calif. Materials Sciences Lab.
CHARACTERIZATION OF MX UPPER STAGE SUBSCALE CARBON-CARBONS Interim Report
Jay G. Baetz, J. Stephen Evangelides, and Anthony F. DiGiacomo 11 Mar. 1977 124 p refs
(Contract F04701-76-C-0077)
(AD-A038159; TR-0077(2622-02)-1; SAMSO-TR-77-34) Avail: NTIS HC A06/MF A01 CSCL 21/8

The most significant characteristics of the carbon-carbon materials employed by Aerojet Solid Propulsion Company in the MX upper-stage subscale nozzle tests have been determined. These carbon-carbons included two dimensionally reinforced structures of both flat laminate and rosette construction as well as a three dimensionally reinforced composite. Results of these studies characterize the materials by their response to the original fabrication process and to the rocket test environment. The evaluation concentrated on microstructural and macrostructural examination, posttest surface roughness measurements, thermal expansion and thermal stability of the composite, and evaluation of the density/porosity/pore structural relationships. Conclusions regarding the materials: operating performance and processing conditions are given, and recommendations for future studies are presented. Author (GRA)

N77-29220# Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.
DESCRIPTION AND USE OF THE PLUME RADIATION CODE ATLES Interim Report
Stephen J. Young 13 May 1977 102 p refs
(Contract F04701-76-C-0077; DARPA Order 2843)
(AD-A040537; TR-0077(2753-04)-3; SAMSO-TR-77-100) Avail: NTIS HC A06/MF A01 CSCL 09/2

The computer code ATLES is designed to compute the infrared radiance signatures of missile and aircraft exhaust plumes with allowance for attenuation by arbitrary atmospheric slant paths. The code is significantly improved over existing radiation codes through the use of newly developed band radiation formulations for nonuniform optical paths and the use of temperature-consistent band model parameters. Descriptions of the radiation formulation and some of the significant computational routines are presented. The latter include the geometry of intersection between an arbitrary line of sight through the atmosphere and a plume contained within a paraboloid control volume. Detailed instructions on the preparation of input data are presented, and use of the code is illustrated by an application to a jet-aircraft plume.
Author (GRA)

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N77-29221 Michigan Univ., Ann Arbor.
ELECTRICAL PROPERTIES, NONSTOICHIOMETRY AND DEFECT STRUCTURES OF PURE AND NIOBIUM PENTOXIDE-DOPED CERIUM DIOXIDE Ph.D. Thesis
Ishverlal Kunverji Naik 1976 157 p
Avail: Univ. Microfilms Order No. 77-8003

Properties of pure and niobium pentoxide-doped CeO2 were determined to arrive at the defect structures of these oxides. In the temperature and oxygen partial pressure (pO2) ranges of this investigation, nonstoichiometric CeO2 is an oxygen-deficient oxide exhibiting n-type conductivity. The electrical conductivity data indicated that the point defects in CeO2 are doubly ionized oxygen vacancies at high O2 and therefore at small values of x. This oxygen vacancy model is consistent with the nonstoichiometry data. The high temperature electrical conduction occurs by a hopping mechanism; the Friedman-Holstein small polaron model explains the high temperature electron mobility in CeO2-x. The Nb2O5-doped CeO2 is an n-type semiconductor. At high pO2, Nb(5+) ions are substitutionally incorporated in the CeO2 lattice by the two possible charge-compensating mechanisms, (1) reduction of some Ce(4+) ions to Ce(3+) state and (2) formation of oxygen interstitials. Dissert. Abstr.

N77-29222*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELECTROCHEMICAL BEHAVIOR OF 0.2 TO 3 MOLAR FERROUS CHLORIDE-FERRIC CHLORIDE MIXTURES ON EDGE-ON PYROLYTIC GRAPHITE ROTATED DISK ELECTRODES
Riley Q. Miller Jul. 1977 12 p refs
(Contract E(49-28)-1022)
(NASA-TM-X-73716; ERDA/NASA-5022-77/2; E-9199) Avail: NTIS HC A02/MF A01 CSCL 07C

Potentiostatic determinations in various mixtures of FeCl2-FeCl3 with excess HCl show rest potentials that are 0.1 V less electropositive than the theoretical values from the formulated ratios of FeII to FeIII (probably as a result of complexing). The standard rate constant sub s. ranges between 0.0001 and 0.000 cm/sec. Tafel slopes b of roughly 0.12V per decade indicate single-electron exchange kinetics. No significant trend in either b or sub s was attributed to mixture composition. The higher sub s. values occurred with and edge-on pyrolytic graphite that had undergone a permanent surface change. Author

N77-29223# California Univ., Los Angeles. Dept. of Chemistry.
DEUTERIUM EXCHANGE AT TERMINAL BORON-HYDROGEN BONDS CATALYZED BY CERTAIN TRANSITION METAL COMPLEXES. A QUALITATIVE STUDY OF SELECTIVITY AND MECHANISM Interim Report
Elvin L. Hoel, Mehdi Talebinasab-Savari, and M. F. Hawthorne 15 Mar. 1977 73 p refs Submitted for publication
(Contract N00014-76-C-0390; NR Proj. 053-608)
(AD-A038118; TR-96; Contrib-3579) Avail: NTIS HC A04/MF A01 CSCL 07/3

A wide variety of substrates, including carboranes, metallocarboranes, and boron hydrides, were found to undergo catalytic isotopic exchange of terminal hydrogen with deuterium gas in the presence of various transition metal complexes. A mechanism is postulated which rationalizes the varied results and which involves oxidative addition of boron-hydrogen bonds to catalytic species. GRA

N77-29224# Naval Air Engineering Center, Lakehurst, N.J. Ground Support Equipment Dept.
ELECTRIC GENERATOR DEVELOPMENT FOR THE 1980'S Interim Report, Jul. 1975 - Jun. 1976
William Uellner 19 May 1977 88 p refs
(WF41461400)
(AD-A040266; NAEC-GSED-107) Avail: NTIS HC A05/MF A01 CSCL 10/2

This report outlines the work to date to develop a 400 Hz, 30KVA, mobile electric power plant (MEPP) that complies with the new standard for ground power, MIL-STD-704B. A computer aided design was used to develop engineering generator system parameters from the desired specified output parameters for voltage regulation, frequency stability, etcetera, under load/no load conditions. Because of the proven close correlation between the computer model and the final end item of equipment, it is recommended that work continue to finalize the MEPP design. GRA

24 COMPOSITE MATERIALS

Includes laminates.

N77-29225 Purdue Univ., Lafayette, Ind.
SOME PROBLEMS OF INTERFACIAL CRACKS Ph.D. Thesis
Daniel Star Wolf 1976 92 p
Avail: Univ. Microfilms Order No. 77-7548

The behavior of the stress field surrounding cracks lying on or near a material interface within a composite material is studied, to determine the effects of dynamic stresses, thermal stresses and couple-stresses. Stresses are examined in the vicinity of a semi-infinite interfacial crack moving at a constant velocity. For plane motion the crack tip stresses are found to oscillate in the vicinity of the crack tip, while for the anti-plane motion the crack tip stresses do not oscillate. Also studied is a stationary interfacial crack of finite length subjected to thermal loads induced by a change in temperature. Again the crack tip stresses are found to oscillate in front of the crack tip. Fracture failure is enhanced by a drop in ambient temperature. A pressurized crack of finite parallel to a material interface is investigated. Dissert. Abstr.

N77-29226*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
X-RAY PHOTOELECTRON SPECTROSCOPY STUDY OF RADIOFREQUENCY SPUTTERED CHROMIUM BROMIDE, MOLYBDENUM DISILICIDE, AND MOLYBDENUM DISULFIDE COATINGS AND THEIR FRICTION PROPERTIES
Donald R. Wheeler and William A. Brainard Washington Aug. 1977 21 p refs
(NASA-TN-D-8482; E-9059) Avail: NTIS HC A02/MF A01 CSCL 11D

Radiofrequency sputtered coatings of CRB2, MOSI2, and MOS2 were examined by X-ray photoelectron spectroscopy. The effects of sputtering target history, deposition time, RF power level, and substrate bias on film composition were studied. Friction tests were run on RF sputtered surfaces of 440-C steel to correlate XPS data with lubricating properties. Significant deviations from stoichiometry and high oxide levels for all three compounds were related to target outgassing. The effect of biasing on these two factors depended on the compound. Improved stoichiometry correlated well with good friction and wear properties. Author

N77-29227# Aeronautical Research Inst. of Sweden, Stockholm.
INFLUENCE OF ENVIRONMENTAL CYCLING ON THE MECHANICAL PROPERTIES OF COMPOSITE MATERIALS
Christer Lundemo Jan. 1977 71 p refs
(Contract FMVF-82223-75-083-07-001)
(FFA-TN-HU-1853) Avail: NTIS HC A08/MF A01

Static and fatigue tests were carried out on carbon fiber reinforced plastic specimens exposed to environmental conditions with the purpose of simulating the real environmental conditions for today's aircraft. The investigation comprised + or - 45 deg reinforced test specimens 24 mm wide and 1 mm thick, built up from carbon fiber prepreg Thornell 300/Narmco 5208. In the investigation, polyurethane covered specimens were also tested in order to investigate the protecting ability of that material. The results clearly show a degradation of both the static and fatigue properties due to environmental exposure. For short periods, the material became more ductile through the influence of moisture. For longer periods, debonding between the fibers and the matrix could be noticed. Environmental degradation became more pronounced if the specimens were preloaded prior to exposure. Author (ESA)

N77-29228# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
STRESS ANALYSIS OF FIBRE REINFORCED PLATES WITH POLAR ORTHOTROPY
E. H. Mansfield London Aeron. Res. Council 1977 35 p refs Supersedes RAE-TR-75060; ARC-36239
(ARC-R/M-3796; RAE-TR-75060; ARC-36239) Avail: NTIS HC A03/MF A01; HMSO £4; PHI $15.30

The stress analysis of elastic plates with polar orthotropic properties is considered. The analysis is applicable to fiber reinforced composites in the form of an annulus or curved strip with circumferential fibers. For certain simple loading conditions, including those of pressure, moment and shear, curves are presented which give the maximum stresses for a wide range of composite geometries and elastic properties. Author (ESA)

N77-29229# Centre National de la Recherche Scientifique, Marseilles (France). Lab. d'Astronomie Spatiale.
SPACE APPLICATIONS OF REFLECTING COATINGS ON THE 300 A TO 2000 A RANGE [APPLICATIONS SPATIALES DE TRAITEMENTS REFLECHISSANTS DANS LA BANDE 300 A - 2000 A]
M. Blanc and A. Malherbe (Engins Matra, Velizy, France) 31 Jan. 1976 20 p refs In FRENCH; ENGLISH summary
(LAS-76-OPT-PHY-04) Avail: NTIS HC A02/MF A01

In connection with the D-2B astronomical project, the possibility of obtaining high reflectivity coatings for the vacuum ultraviolet range was studied. After consideration of a number of thin film treatments the Al-Mg F2 coating was selected for the EL7 and EAS experiments. ESA

N77-29230# Illinois Univ., Urbana-Champaign. Dept. of Aeronautical and Astronautical Engineering.
NON LINEAR DYNAMIC ANALYSIS OF FLAT LAMINATED PLATES BY THE FINITE-ELEMENT METHOD Contractor Report, 1 Jan. 1975 - 30 Jun. 1976
A. R. Zak Mar. 1977 81 p refs
(Contract DAAD05-73-C-0197; DA Proj. 1T1-61102-A-33H)

(AD-A038427) Avail: NTIS HC A05/MF A01 CSCL 13/13

A finite-element structural model has been developed for the dynamic analysis of laminated, thick plates. The model uses constant thickness quadrilateral elements to represent the shape of the plate and these elements are stacked in the thickness direction to represent the desired material layers. The analysis allows for orthotropic material properties of each layer as well as for elastic-plastic material response. Nonlinear strain displacement relations are used in the formulation to represent large, transverse plate deflections. The finite-element model is used to prepare a computer program for the numerical calculations. Two versions of the program have been prepared, which correspond to two different time integration numerical methods. These methods include finite-difference and predictor-corrector techniques. The computer programs are designed for time and space dependent pressure loads to be applied to one surface of the plate. However, the programs could be used for other loading conditions by changing one subroutine. Author (GRA)

N77-29231# General Dynamics/Convair, San Diego, Calif.

INVESTIGATION OF DAMAGE TOLERANCE OF GRAPHITE/EPOXY STRUCTURES AND RELATED DESIGN IMPLICATIONS Final Report, Jul. 1975 - Nov. 1976

N. R. Adsit and J. P. Waszczak 14 Dec. 1976 76 p

(Contract N62269-75-C-0385)

(AD-A038936; NADC-76387-30) Avail: NTIS HC A05/MF A01 CSCL 11/4

This investigation was undertaken to evaluate the damage tolerance of typical graphite/epoxy structure to service damage. AS/3501 graphite/epoxy I-stiffened panels and honeycomb panels were fabricated and its tolerance to low-velocity impacts was measured. Three impact threats were investigated; runway stones, a blunt impactor with a tip radius of 0.64cm (1/4 inch), and a blunt impactor with a tip radius of 2.54cm (1 inch). Impact parameters were selected that would just cause visual damage. This worked well for the runway stones, but for the tests of the one-inch penetrator on the honeycomb panels visual damage was not easily observed. C-scan damage was, however, easily detectable. Residual strength specimens were cut from the damaged panels and tested. The specimens contained damage at levels of 70, 100, 130% of the level to cause visual (or C-scan) damage. GRA

N77-29232# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mechanical Engineering, Aeronautical Engineering and Mechanics.

LOAD TRANSFER AND SURFACE WAVE PROPAGATION IN FIBER REINFORCED COMPOSITE MATERIALS

M. Jahanmir and H. F. Tiersten Mar. 1977 35 p refs

(Contract N00014-76-C-0368; NR Proj. 318-009)

(AD-A039046; TR-20) Avail: NTIS HC A03/MF A01 CSCL 11/4

A system of linear elastic equations recently obtained for fiber reinforced composite materials is applied to some simple problems concerning the transfer of load from the reinforcement to the matrix. The same equations are applied to surface waves propagating in the direction of the fiber reinforcement. Since the defined constants occurring in the above-mentioned linear equations for a two-constituent composite material have never been measured, calculations cannot be performed. When the model is simplified sufficiently, the effective constants in the description can be partially estimated from the known elastic constants of the individual constituent in the composite. With the reduced equations calculations are performed for surface waves propagating both in and normal to the direction of the fiber reinforcement. The calculations indicate the existence of a high (optical type) as well as a low (acoustic type) surface wave mode, both of which are dispersive. It is believed the optical type mode is an analytical consequence of the simplified model and does not actually exist. The dispersion of the acoustic type surface wave mode could provide a means of non-destructively evaluating the integrity of a fiber reinforced composite material. Author (GRA)

N77-29233# Catholic Univ. of America, Washington, D. C.

MEAN FIELD VARIATIONS IN RANDOM MEDIA Final Report, 1 Jan. 1975 - 31 Dec. 1976

John J. McCoy 1 Apr. 1977 11 p refs

(Contract DAHC04-75-G-0069; DAAG29-76-G-0084)

(AD-A039836; ARO-12334.3-E) Avail: NTIS HC A02/MF A01 CSCL 20/11

A brief review is provided of research to incorporate more detailed information of substructure geometry, when compared to volume fraction information, in bounds on the effective property measures of composite materials. In addition, the need for a coherence function formulation of stress waves in randomly heterogeneous materials are discussed and some steps are taken toward developing this formulation. GRA

N77-29234# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.

MECHANICAL PROPERTIES FOR THICK FIBER REINFORCED COMPOSITE MATERIALS HAVING TRANSVERSELY ISOTROPIC FIBERS

Ronald D. Kriz and Wayne W. Stinchcomb May 1977 104 p refs

(Grant AF-AFOSR-2358-72)

(PB-266364/9; VPI-E-77-13) Avail: NTIS HC A06/MF A01 CSCL 11D

Equations are used to obtain lamina and fiber properties at any fiber volume fraction. Improvements on experimental ultrasonic techniques for determining experimental properties were demonstrated. Specimen sizing was calculated based on energy flux deviation from the plane wave normal. It was found that transversely isotropic fiber properties are accurately obtained by curve fitting experimental data. Graphite fibers were shown to be definitely transversely isotropic. GRA

N77-29235# Illinois Inst. of Tech., Chicago. Dept. of Metallurgical and Materials Engineering.

IMPACT STRENGTH AND TOUGHNESS OF FIBER COMPOSITE MATERIALS Final Report, 1 Nov. 1971 - 31 Oct. 1976

Lawrence J. Broutman Jan. 1977 25 p refs

(Grant AF-AFOSR-2214-72; AF Proj. 6813; AF Proj. 9782)

(AD-A036566; AFOSR-77-0092TR) Avail: NTIS HC A02/MF A01 CSCL 11/4

Specimens in the shape of rectangular cross section beams were prepared and tested. The following variables have been studied: Specimen geometry, Impact velocity, Effect of notch, and Orientation of lamination planes with respect to impact load. The failure was observed using a high speed movie camera and the movies were analyzed to determine and create a model of the fracture process. The studies had shown that glass fiber reinforced epoxies are rate sensitive when an impact load is applied to them. The mechanism of oaborbind energy is delamination between layers and between fibers, thus, the type of glass fiber does not change the toughness of the material. It was found that the orientation of the lamination plies with respect to the impact load direction will have a great influence on the mode of fracture and energy absorption. The studies with the carbon fiber composites reveal the brittle nature of this material, particularly when compared to the glass fiber composites. Additional research was accomplished in four general areas: Impact property study of angle-ply laminates, Optimization of impact properties of hybrid composites, Effect of Interface strength of impact of glass fiber laminates, and Study of energy absorbing mechanisms in glass fiber composites. GRA

N77-29236# Stanford Univ., Calif. Dept. of Mechanical Engineering.

DISPERSION RELATIONS AND MODE SHAPES FOR WAVES IN LAMINATED VISCOELASTIC COMPOSITES BY VARIATIONAL METHODS Final Report

Subrata Mukherjee (Cornell Univ., Ithaca, N.Y.) and E. H. Lee Oct. 1976 34 p refs

(Contract N00014-75-C-0698; NR Proj. 064-471)

(AD-A036431; SU-DAM-76-4) Avail: NTIS HC A03/MF A01 CSCL 11/4

The propagation of oscillatory waves through periodic elastic composites has been analyzed on the basis of Floquet theory. This leads to self-adjoint differential equation systems which it has proved convenient to solve by variational methods. Many composites, such as the light-weight high-strength boron-epoxy material, consist of strong reinforcing components in a plastic matrix. The latter can exhibit viscoelastic properties which can

have a significant influence on wave propagation characteristics. Replacement of the elastic constant by the viscoelastic complex modulus changes the mathematical structure so that the differential equation system is no longer self-adjoint. However, a modification of the variational principles is suggested which retains formal self-adjointness, and yields variational principles which contain additional boundary terms. These are applied to the determination of wave speeds and mode shapes for a laminated composite made of homogeneous elastic reinforcing plates in a homogeneous viscoelastic matrix for plane waves propagating normally to the reinforcing plates. These results agree well with the exact solution which can be evaluated in this simple case. The variational principles permit solutions for periodic, but otherwise arbitrary variation of material properties. GRA

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N77-29237 California Univ., Los Angeles.
DESIGN AND CONSTRUCTION OF A SPECTROMETER FACILITY AND EXPERIMENT FOR INTERMEDIATE ENERGY PROTON SCATTERING ON HELIUM Ph.D. Thesis
Robert Menuhin Rolfe 1976 482 p
Avail: Univ. Microfilms Order No. 77-8531

Proton scattering on nuclei at intermediate energies and in particular proton scattering on helium were investigated. A theoretical investigation of the helium nucleus and the nature of the intermediate energy interaction was made. Design and optimization of an energy-loss spectrometer facility for proton-nucleus scattering are discussed. The unique superfluid helium target and experimental design are described. Dissert. Abstr.

N77-29238 Arizona Univ., Tucson.
ON HIGH RESOLUTION SPECTROSCOPY: THEORY AND EXPERIMENT Ph.D. Thesis
Eric William VanStryland 1976 171 p
Avail: Univ. Microfilms Order No. 77-7326

Methods of determining spectroscopic quantities are discussed both experimentally and theoretically. The ultimate limitations on signal-to-noise ratios in such experiments are also discussed. A method is described of directly determining transition dipole matrix elements which have been used to make the first measurements of this quantity in an asymmetric rotor. A low pressure gas which is subjected to a CW CO2 laser beam is suddenly Stark switched into resonance. An optical nutation signal is detected whose frequency yields the transition dipole matrix element of interest and the optical field strength which may be determined from power and beam profile measurements. The extension of this technique to nonpolar molecules and its advantages over conventional steady state laser methods are discussed. Dissert. Abstr.

N77-29239 Columbia Univ., New York.
NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY IN SMECTIC LIQUID CRYSTAL SOLVENTS Ph.D. Thesis
Anthony James Montana 1976 145 p
Avail: Univ. Microfilms Order No. 77-6654

The application of smectic liquid crystals as anisotropic solvents in measurements of the chemical shielding anisotropy, and other structural parameters, has been found to be an extremely useful spectroscopic tool. The measurement of H1, F19, and P31 shielding anistropies for various solute molecules was accomplished using the improved liquid crystal techniques. The anistropies are transformed from the molecule symmetry axis system into parallel and perpendicular components in the bond axis system, so that correlations and comparisons of shielding components for various molecular families were obtained. F-P-F bond angle in PSF3 and the absolute signs of the indirect spin-spin coupling constants in PSF3, the fluoromethanes, and various trimethylphosphine derivatives are also reported. Dissert. Abstr.

N77-29240 Columbia Univ., New York.
LASER STUDIES OF NANOSECOND FLUORESCENCE AND ELECTRONIC ENERGY TRANSFER Ph.D. Thesis
Stephen Lemont 1976 123 p
Avail: Univ. Microfilms Order No. 77-8870

Direct measurement of fluorescent lifetimes was accomplished, employing a mode-locked argon ion laser excitation source with a photodiode detector and a sampling oscilloscope interfaced with an analog signal averager. Using this technique, the fluorescence decay times of three dyes, Rhodamine 6G (tau = 5.82 + or - 0.64 nsec), Rhodamine 3G (tau = 1.36 + or - 0.11 nsec), and Sulforhodamine B (tau = 3.23 + or -0.25 nsec) were determined. The time correlated single photon counting technique with a mode-locked He-Ne laser excitation source was used to determine the radiative lifetime and quenching cross-section for excited-state-K2/k collisions. These were found to be 12.2 + or - 0.2 nsec and 162 + or - 7 sq.A respectively. Also, the E-V energy transfer rate from electronically excited bromine atoms was found to be 39 + or - 11 per msec per torr. When fluorescene rise-and fall-rates are close together in magnitude, they become convoluted as to mask the true rates. An approximate mathematical technique is described which can be used to deconvolute data in such cases. Dissert. Abstr.

N77-29241 Notre Dame Univ., Ind.
PHYSICAL STUDIES ON THE DYNAMICAL STRUCTURES OF MICELLAR ASSEMBLIES Ph.D. Thesis
Kuppuswamy Kalyanasundaram 1977 218 p
Avail: Univ. Microfilms Order No. 77-8137

The static and dynamical properties of micelles formed by a wide variety of ionic and nonionic surfactants have been investigated by fluorescene probe, pulsed NMR relaxation, laser Raman scattering and pulse radiolysis techniques. The properties investigated include: extent of water penetration, role of micellar headgroup, nature and extent of counterion binding, permeability, segmental mobility and conformational aspects of various parts of ionic and nonionic micelles. Dissert. Abstr.

N77-29242 Illinois Univ., Urbana-Champaign.
HIGH PRESSURES NUCLEAR MAGNETIC RESONANCE STUDIES OF TRANSPORT PROPERTIES IN DENSE FLUIDS Ph.D. Thesis
Raymond Joseph Finney 1976 149 p
Avail: Univ. Microfilms Order No. 77-8992

The F(19)NMR spin-lattice relaxation times, and self-diffusion coefficients, and shear viscosities of several molecular systems have been experimentally determined. The overall goal of this work is: (1) to examine the effects of extreme conditions of temperature and pressure on these transport phenomena, and (2) to better understand the dynamics of molecular motions in a defense fluid. The results of this study indicate that the dynamic of perfluorocyclobutane approximate those of hard sphere fluid. The nuclear spin relaxation of a spherical top molecule, carbon tetrafluoride, was determined and analyzed. It was concluded that: (1) the hard sphere diameter is slightly temperature dependent, (2) the angular momentum relaxation can be approximated using Enskog theory, and (3) the angular momentum relaxation for carbon tetrafluoride cannot be approximated as a smooth hard sphere system. Dissert. Abstr.

N77-29243 Wisconsin Univ., Madison.
AN INSTRUMENT SYSTEM FOR AXIAL EXTRACTION OF LIGHT AND SPECIES FROM AN ATMOSPHERIC-PRESSURE SPARK DISCHARGE Ph.D. Thesis
Robert Lawrence Watters, Jr. 1976 167 p
Avail: Univ. Microfilms Order No. 77-3434

The design, construction, and initial testing of a spark source interfaced with a large vacuum system are described. The utility of pulsed extraction of the atmospheric-pressure spark discharge is outlined from the pumping requirements. The importance of presenting a clear aperture from the spark to the vacuum system during the pulse resulted in the design and fabrication of a nozzle-electrode and shutter system. Details of the shutter design and its adjustment are given. Conclusions are drawn regarding the utility of axial extraction of the spark discharge. The ability

to directly analyze optical and vacuum ultra-violet radiation exclusively from the spark channel provides an independent means of characterizing the plasma species. Finally, the geometry of the discharge electrode system and the means of extraction are considered as a possible particle source for sensitive mass spectrometric analysis. Dissert. Abstr.

N77-29244 Purdue Univ., Lafayette, Ind.
THE USE OF COMPUTER-ASSISTED CHROMATOGRAPHIC METHODS FOR THE CHARACTERIZATION OF STATIONARY PHASES Ph.D. Thesis
Frank Joseph VanLenten 1976 156 p
Avail: Univ. Microfilms Order No. 77-7543

Five pure oligomers from two batches of a commercial polysiloxane stationary phase were isolated from the oligometric mixture by supercritical fluid chromatography. These pure oligomers were used as individual stationary phases on statically-coated glass capillary columns for characterization by high precision gas chromatography. The significant differences that were found between batches appear to be due primarily to changes in the percentage of one oligomer, the cyclic pentamer. This finding emphasized the desirability of using a pure stationary phase as well as carefully specifying the column temperature in order to improve intra- and inter-laboratory comparisons of retention indices. A computer automated system for controlling the important variables in supercritical fluid chromatography is discussed. Dissert. Abstr.

N77-29245 Purdue Univ., Lafayette, Ind.
APPLICATIONS OF HIGH-PRECISION GAS CHROMATOGRAPHY Ph.D. Thesis
Richard Eugene Pauls 1976 187 p
Avail: Univ. Microfilms Order No. 77-7515

High precision gas chromatography was used in conjunction with a quadrupole mass filter and an on-line computer to study the fractionation of oxygen isotopes. Values of relative retention on the order of 1.002 were obtained. Also, the accuracy and precision of calculating retention times from means and peak maxima were examined using an exponentially modified Gaussian distribution as a model for tailed chromatographic peaks. The effects on chromatographic peak shape of dead volume and flow rate were examined using the standard deviation of the Gaussian component of the peak and the exponential decay constant; better precision was obtained in calculating skew and excess than that obtained using the summation technique. Variations in experimental parameters in recycling chromatography were also investigated. The maximum number of cycles was obtained under conditions which minimized effects of gas compressibility. Dissert. Abstr.

N77-29246 Wisconsin Univ., Madison.
DESIGN OF A LARGE VERSATILE INSTRUMENTAL COMPLEX TO OBSERVE THE PROCESS OF SPARK DISCHARGE Ph.D. Thesis
David Manley Coleman 1976 589 p
Avail: Univ. Microfilms Order No. 77-3393

New instrumentation has been developed to permit observations on the spark discharge which contribute to its understanding as a sequential process of diverse chemical and physical events. A model in which a long-lived, ionic, post-discharge environment influences the character of a sequence of sparks, is presented. An experimentally verified consequence is that the nature of an individual spark, isolated for observation from a train of sparks, must be described in terms of the influence of those sparks which preceded it. Dissert. Abstr.

N77-29247 Florida Univ., Gainesville.
TIME-RESOLVED OPTO-ACOUSTIC SPECTROSCOPY Ph.D. Thesis
Joseph Jude Wrobel 1976 186 p
Avail: Univ. Microfilms Order No. 77-8243

Excited state radiationless processes of large molecules in the vapor phase are studied, focusing on the opto-acoustic effect, the generation of temperature and pressure fluctuations in a sample upon absorption of optical energy. The set of heat flow equations governing this effect are constructed and solved, under certain restrictions, for a sample in an isothermal cylindrical cell acted on by a short pulse of light. Computer simulations of the expected pressure signals are presented, and it is shown how molecular parameters can be extracted from experimental measurements. Limitations on experimental design imposed by theoretical assumptions are discussed and applied to the construction of an experimental system for performing time-resolved opto-acoustic spectroscopy. The properties of oxalyl chloride are examined, and it is chosen as the object of experimental study. Dissert. Abstr.

N77-29248 Wisconsin Univ., Madison.
REACTION KINETICS BY CHROMATOGRAPHIC TECHNIQUES Ph.D. Thesis
Huel Rodger Melton 1976 415 p
Avail: Univ. Microfilms Order No. 77-3414

The kinetics of dissociation of three methylcyclopentadiene isomeric dimers were studied, using a gas chromatographic column as the chemical reactor. Solvent effects on the dissociation reactions of the dimers were studied by determining liquid phase rate constants in several chromatographic stationary phases. Additional insight into the physical behavior inside the reactor was gained from evaluation of the dimer and monomer solution thermodynamics. In a related liquid phase study, a technique was developed to measure the activity of immobilized enzyme (lactase) supported on porous glass beads. The immobilization process was studied using a fractional factorial design. Results are evaluated to suggest the optimal conditions for immobilization. Dissert. Abstr.

N77-29249 Stanford Univ., Calif.
HIGH TEMPERATURE LOW PRESSURE MOLECULAR BEAM STUDY ON THE REACTION OF POLYCRYSTALLINE MOLYBDENUM WITH CHLORINE AND OXYGEN Ph.D. Thesis
Danny Yuk-Kwan Ngan 1976 351 p
Avail: Univ. Microfilms Order No. 77-7136

Six different reaction mechanisms were theoretically analysed for a modulated reactant beam reacting with the surface. $MoCl_2$ was the major reaction product formed in the pure chlorine reaction. Tis reaction mechanism was identified as a parallel reaction scheme, $MoCl_2$ being formed either through the fast reaction route (via sites A) consisting of a fast surface reaction step, or through the slow route (via sites B) consisting of a slow surface reaction followed by a surface diffusion limiting step. Sites B became saturated at high chlorine pressure. In the mixed gas reaction mechanism for MoO_2Cl_2 (the major product) formation was similar to that for $MoCl_2$ formation; instead of chlorine adsorbing on bare metal sites, chlorine was adsorbing on oxygen-covered sites. Sites B again became saturated at high chlorine pressure. While oxygen enhanced the rate of reaction, chlorine tended to slow down the rate of reaction at high pressure. Dissert. Abstr.

N77-29250 Michigan Univ., Ann Arbor.
ULTRASONIC EMULSIFICATION Ph.D. Thesis
Ming Kung Li 1976 371 p
Avail: Univ. Microfilms Order No. 77-7972

For a given oil-water emulsion system, the average particle size decreases and the size distribution narrows with increasing irradiation time to form a monodisperse size distribution. The differences in the stable values of the mean sizes for different oils can be examined from a model based on the deformation and the breakup of a liquid droplet under exposure to a pressure shock. Large droplets originally formed from the oil-water interface as a result of the instability are disintegrated into smaller ones until the critical size is reached. The disintegration mechanism in this system is a result of droplets experiencing similar impact as in gas-liquid systems, namely, the intense shockwaves generated from the surrounding cavitation medium in an ultrasonic field. Because of this similarity, the stable drop size can be characterized on the basis of the corresponding Ohnesorge number and the Weber number ratio. Dissert. Abstr.

N77-29251 Michigan Univ., Ann Arbor.
STUDY OF CARBURIZATION AND DECARBURIZATION OF Fe THIN FILMS BY CONVERSION ELECTRON MOESSBAUER SPECTROSCOPY Ph.D. Thesis
James Gordon Goodwin, Jr. 1976 124 p
Avail: Univ. Microfilms Order No. 77-7923

Vacuum evaporated Fe films were studied using a controlled-gas system. After preparation these films contained on the order of 8 at. percent carbon through the 2x10 to the minus seventh power evaporation took place at torr. It is suggested that the carbon contamination occurred during deposition of the films as a result of the presence of carbon-containing species in the residual gas in the vacuum chamber. Decarburization of these films was undertaken in hydrogen temperatures less than 520 C. It was discovered that the particular Fe carbide precipitated in a film greatly affected the decarburization rate. Heating the films hydrogen at temperatures less than 300 C resulted in the precipitation of the chi and theta carbides and a decrease in the carburization rate. It is suggested that this decrease may be caused by an increase in the Fe-C bond strength. At 500 C the rate of decarburization became essentially constant at sharp decrease could be correlated to carbon surface segregation.
Dissert. Abstr.

N77-29252*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PROCESS FOR THE PREPARATION OF CALCIUM SUPEROXIDE Patent Application
E. Vernon Ballou (San Jose State Univ., Calif.), Peter C. Wood (San Jose State Univ., Calif.), LeRoy A. Spitze (San Jose State Univ., Calif.), and Theodore J. Wydeven, Jr., inventors (to NASA) Filed 11 Jul. 1977 29 p
(NASA-Case-ARC-11053-1; US-Patent-Appl-SN-814378) Avail: NTIS HC A03/MF A01 CSCL 07D

Calcium superoxide is prepared in high yields by spreading a quantity of calcium peroxide diperoxhydrate on the surface of a container; positioning said container in a vacuum chamber; partially evacuating said vacuum chamber, allowing the temperature of the diperoxhydrate to reach to a level within the range of about 0 deg to about 40 C; maintaining the temperature selected for a period of time sufficient to complete the disproprotionation of the diperoxhydrate to calcium superoxide, calcium hydroxide, oxygen and water; constantly and systematically removing the water as it is formed; backfilling the chamber with a dry inert gas; and finally recovering the calcium superoxide produced.
NASA

N77-29253# Delaware Univ., Newark. Dept. of Chemistry.
THE ENTHALPY OF INTERACTION OF NONELECTROLYTE PAIRS IN DILUTE AQUEOUS SOLUTIONS Ph.D. Thesis Special Publication, Jul. 1973 - Jan. 1975
James J. Savage Apr. 1977 88 p refs
(Contract DAAA15-71-A-0074)
(AD-A040164; EC-SP-77004; ARCSL-SP-77003) Avail: NTIS HC A05/MF A01 CSCL 07/4

The enthalphy of dilution of single- and binary-solute aqueous mixtures of a series of compounds were measured from about 0.2 to 2 mol/kg at 25 C. The compounds included in the study were N-methylformamide, N-methylacetamide, N-methylpropionamide, N-butylacetamide, urea, ethylene glycol, pentaerythritol, glucose and sucrose. The apparent molal volumes of each solute in dilute aqueous solutions were measured at 0, 25, and 45 C. A statistical analysis of the excess enthalpy data showed that solute-pair heats of interaction could be roughly represented by a sum of several independent group interactions. The sign and magnitude of the six interactions between a CH2, CONH and CHOH functional group are reported. These group interaction values were used to calculate the pairwise heats of interaction for several previously reported nonelectrolytes to within 45 cal kg/sq. mol of prior experimental values.
Author (GRA)

N77-29254# Sandia Labs., Albuquerque, N. Mex.
APPLICATION OF THIRD ORDER NONLINEAR OPTICAL TECHNIQUES TO THE DIAGNOSIS OF COMBUSTING MEDIA
A. Owyoung Jan. 1977 44 p
(Contract EY-76-C-04-0789)
(SAND-77-0005) Avail: NTIS HC A03/MF A01

Spontaneous Raman Scattering (SRS) and the relative merits of three nonlinear optical techniques for gas diagnostics are examined. These techniques are coherent anti-Stokes Raman spectroscopy, stimulated anti-Stokes Raman spectroscopy, stimulated anti-Stokes Raman spectroscopy, and the Raman-induced Kerr effect. Detection limits are placed on each of these techniques by examining a representative example of a trace dinsity of nitrogen gas in a background mixture at one atmosphere. It is found that nonlinear techniques offer significant improvements over SRS in applications where discrimination against fluorescence, time resolution, and spectral resolution is desired.
ERA

N77-29255# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Luftstrahlantriebe.
EXPERIMENTAL AND THEORETICAL INVESTIGATIONS ON COAXIAL AND ON TURBULENT FREE JET DIFFUSION FLAMES
Heinrich Eickhoff and Frank Thiele (Tech. Univ. Berlin) 11 Jan. 1977 16 p refs Presented at the Air Force Combust. Conf., Dayton, Ohio, Aug. 1976
(DLR-FB-77-01) Avail: NTIS HC A02/MF A01; DFVLR, Cologne DM 8.80

Numerical calculations of time mean values of temperature, velocity, and chemical species in a free jet hydrogen-flame and a coaxial hydrogen-air-flame are compared to measurements. Simple algebraic relations are used for the turbulent transport. The molecular unmixedness is taken into account by the concentration fluctuations. Furthermore the influence of combustion on the kinetic energy distribution is studied numerically by the according transport equation. The result is compared qualitatively to measurements.
Author (ESA)

N77-29256# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
INVESTIGATION OF ENERGY DISTRIBUTION IN REACTION PRODUCTS OF VIBRATIONALLY EXCITED CN RADICALS WITH O(3P) ATOMS Ph.D. Thesis - Goettingen Univ., West Ger. [UNTERSUCHUNGEN ZUR ENERGIEVERTEILUNG IN DEN PRODUKTEN DER REAKTION SCHWINGUNGSANGEREGTER CN-RADIKALE MIT O(3P)-ATOMEN]
Klaus-Joachim Schmatjko Nov. 1976 79 p refs In GERMAN
(MPIS-30/1976) Avail: NTIS HC A05/MF A01; Max-Planck-Inst. fuer Stroemungsforsch., Goettingen, West Ger. DM 15.45

Distribution of the reaction energy over the products of the atom-radical reaction CN + O yields CO + n was experimentally investigated in the gas phase. CN radicals were produced by flash light photolysis of C2N2 in the presence of oxygen atoms. The formation of reaction products was measured by kinetic resonance-absorption spectroscopy, using a continuous CO laser for CO detection in the infrared and an atomic line lamp for the vacuum UV.
ESA

N77-29257# ARO, Inc., Arnold Air Force Station, Tenn.
AN UNCERTAINTY PROPAGATIONS ANALYSIS FOR AN INFRARED BAND MODEL TECHNIQUE FOR COMBUSTION GAS DIAGNOSTICS Final Report, Jan. 1975 - Jun. 1976
C. C. Limbaugh Apr. 1977 27 p refs
(AD-A038063; ARO-ETF-TR-76-155; AEDC-TR-76-155) Avail: NTIS HC A03/MF A01 CSCL 21/2

The development of matrix equations for an uncertainty propagations analysis for the emission-absorption band model technique are described. The emission-absorption technique is used for the determination of local values of temperature and species concentration for measurements of radiance and transmittance on axisymmetric gas flows. The approach used depends on linearization of the original nonlinear system of equations comprising the solution to the radiative transfer problem for an emitting-absorbing source such as a turbojet or rocket engine exhaust plume. The resultant linear transformation matrix provides a means for determination of the variance-covariance matrix for inverted temperature and partial pressure, based on the experimentally determined variance-covariance matrix of the measured radiance and transmittances. The diagonal elements of the propagated variance-covariance matrix yield the square of the standard deviation of the temperature and partial pressure.
GRA

N77-29258# Ohio Univ., Athens. Dept. of Chemistry.
ON-LINE MEASUREMENT OF THE INFRARED SPECTRA OF GAS CHROMATOGRAPHIC ELUENTS Final Report, 20 Jan. 1975 - 19 Jan. 1976
Peter R. Griffiths Dec. 1976 23 p refs

(Grant EPA-R-803517)
(PB-265570/2; EPA-600/4-76-061) Avail: NTIS HC A02/MF A01 CSCL 14B

Techniques for increasing the sensitivity of the interface between a gas chromatograph and a rapid scanning Fourier transform infrared spectrometer have been developed. A single beam system, in which a triglycine sulfate detector is used to measure the interferogram, has been designed and constructed. Identifiable infrared spectra of submicrogram quantities eluting from a gas chromatograph have been measured without trapping the sample. A double beam configuration has also been designed. GRA

N77-29259# Colorado Univ., Denver. Cardiovascular Pulmonary Research Lab.
DEVELOPMENT OF HIGH PERFORMANCE RESPIRATORY MASS SPECTROMETER Final Report, Jun. 1974 - Dec. 1976
Ingvar E. Sodal Feb. 1977 199 p refs
(Contract N01-HR-33001)
(PB-266646/9; NIH-N01-HR-33001-F) Avail: NTIS HC A09/MF A01 CSCL 06L

A small quadrupole mass spectrometer was designed specifically for use in respiratory gas analysis. This system employs a unique inlet system consisting of a precision servo controlled leak valve making it possible to introduce into the mass analyzer gas samples in a highly controlled manner such that the integrity of the sample is maintained. The system has a high speed of response and it is designed to detect rapid changes in gas mixtures during a single breathing cycle. The mass spectrometer and flowmeter are operated by a small digital computer which also samples the output signals and provides a real-time processing of data. Several programs for cardio-pulmonary test routines have been developed. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N77-29260* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METHOD FOR ATTACHING A FUSED-QUARTZ MIRROR TO A CONDUCTIVE METAL SUBSTRATE Patent
George Sonnenschein (Faraday Labs, Inc., La Jolla, Calif.) and Daniel McKeown, inventors (to NASA) (Faraday Labs, Inc., La Jolla, Calif.) Issued 5 Jul. 1977 4 p Filed 27 Aug. 1976 Supersedes N76-31526 (14 - 22, p 2872) Sponsored by NASA
(NASA-Case-MFS-23405-1; US-Patent-4,033,503; US-Patent-Appl-SN-718267; US-Patent-Class-228-124; US-Patent-Class-228-263) Avail: US Patent Office CSCL 11F

A fused-quartz mirror is attached to a conductive metal substrate by the following steps: tinning one surface of a fused-quartz mirror with a solder of substantially pure indium; tinning a metallic substrate with an indium eutectic alloy consisting essentially of indium bismuth, lead and tin having a melting point substantially below that of indium; heating the eutectic alloy to a temperature substantially above its melting point, but below that of the solder; floating the mirror into place, and subsequently cooling the alloy to a temperature substantially below its melting point.Official Gazette of the U.S. Patent Office

N77-29261 Illinois Univ., Urbana-Champaign.
POROUS ALUMINUM OXIDE COATINGS BY ANODIC SPARK DEPOSITION Ph.D. Thesis
Tran Bao Van 1976 181 p
Avail: Univ. Microfilms Order No. 77-9222

Coatings were made on aluminum anodes from aqueous solutions of NaAlO2 by the process of anodic spark deposition. Although the applied potential ranged from 415 volts to 540 volts dc, more than 97% of the potential drop occurred in the vicinity of the anode, within 0.5mm of the anode. The current density corresponding to a single spark was more than 28,000 amp/sq cm. The lifetime of a single spark was about 0.17 msec. The resulting power density dissipated at the spark location was about 14,000,000 Joules/sec-sq cm or more. Oxygen gas and water vapor were formed at the anode, while H2 gas evolved at the cathode. Anodic spark deposition is believed to be an avalanche process consisting of melting, quenching and recrystallization steps. The aluminum oxide coating was mostly in the form of alpha alumina. Dissert. Abstr.

N77-29262 Illinois Univ., Urbana-Champaign.
LOW TEMPERATURE MAGNETIC RELAXATION STUDIES OF THE MOTION OF HYDROGEN AND DEUTERIUM IN ALPHA IRON Ph.D. Thesis
Joseph Jim-Sai Au 1976 242 p
Avail: Univ. Microfilms Order No. 77-8926

The motion of hydrogen and deuterium and the interaction of H with C, N and dislocations were studied in the temperature range 6 deg - 300 deg K using the magnetic relaxation technique. Three relaxation peaks were observed at 29 K, 34 K and 39 K in pure Fe-H specimens. These peaks were interpreted as being caused by the reorientation of H clusters which can have three different cluster configurations. Other observations and their interpretations discussed include: relaxation peaks at 75 K, 93 K, and 104 K in pure Fe-D specimens; a relaxation peak at T-52 K for the pure Fe-H specimens; trapping of H by C and N to form C-H and N-H clusters; a hydrogen coldwork peak at T=120 K with an activation enthalpy; and a relaxation peak at T=15 K in the Fe-H specimens. Dissert. Abstr.

N77-29263 Illinois Univ., Urbana-Champaign.
ENVIRONMENTALLY INDUCED FRACTURE IN AN ALUMINUM-ZINC-MAGNESIUM ALLOY Ph.D. Thesis
Joseph Lawrence Nelson 1976 152 p
Avail: Univ. Microfilms Order No. 77-9118

Crack propagation during integranular stress corrosion cracking (I-SSC) in a high purity Al-5.5 wt pct Zn-2.5 wt pct Mg alloy in an aqueous NaCl solution was investigated. Brittle intergranular fracture surfaces similar to those produced during I-SCC are observed in the case of tensile specimens which were tested monotonically to failure after either cathodic charging or pre-exposure to moist air. Based on these observations it is concluded that brittle intergranular fracture is the result of hydrogen embrittlement of the grain boundary. Evidence for the existence of a brittle film on the brittle intergranular fracture surfaces suggests that a stress induced aluminum hydride is formed along the grain boundary ahead of the crack tip. Fractographic observations made during the stress corrosion studies indicate that a similar fracture mechanism is occurring during I-SCC. Dissert. Abstr.

N77-29264 Illinois Univ., Urbana-Champaign.
STRAIN CONTROLLED FATIGUE BEHAVIOR OF WELD METAL AND HEAT-AFFECTED BASE METAL IN A36 AND A514 STEEL WELDS Ph.D. Thesis
Yoshisuke Higashida 1976 168 p
Avail: Univ. Microfilms Order No. 77-9028

The mechanical and low cycle fatigue properties and cyclic mean stress relaxation behavior of base metal, heat-affected zone (HAZ), and one- and two-pass weld metals were investigated for ASTM A36 and A514 steel welds. The difference in fatigue resistance was found to be greatest at long lives. The rankings of fatigue resistances (in descending order) at one million cycles were one-pass weld metal, HAZ, two-pass weld metal, base metal, for the A36 steel weld, and HAZ, two-pass weld metal, base metal, one-pass weld metal for the A514 steel weld. The effect of the mean stress on the fatigue life decreased rapidly with cycles for A36 steel welds but did not for A514 steel welds. Hardness was a useful measure of low cycle fatigue behavior of the HAZs and weld metals. Using the data obtained, fatigue crack initiation lives of hypothetical butt welds were predicted. Dissert. Abstr.

N77-29265 Illinois Univ., Urbana-Champaign.
MASSIVE SHORT-RANGE ANTIFERROMAGNETISM IN COPPER-MANGANESE ALLOYS Ph.D. Thesis
Randal Wayne Tustison 1976 216 p
Avail: Univ. Microfilms Order No. 77-9217

Analyses of pairs of adjacent sigma vs H sub i isotherms for Cu75Mn25 in terms of a Brillouin function and a temperature

and field independent susceptibility term indicates that the magnetic clusters, giving rise to the superparamagnetic behavior at temperatures slightly higher than the freezing temperature (T)are also responsible for the unidirectional remanence at 4.2 K in the field-cooled condition. These magnetic clusters are also largely responsible for X sub 4 and for the temperature dependent part of the alternating low field susceptibility at T. Cu-Mn alloys containing between 25 and 66 at.% Mn are mictomagnetic at temperatures below the cusp in the alternating low field susceptibility at T. The freezing temperature, T increases with Mn concentration, as previously reported for alloys containing up to 25 at.% Mn, but it reaches a maximum near 50 at.% Mn and then decreases with further Mn addition. Dissert. Abstr.

N77-29266 Florida Univ., Gainesville.
AN INVESTIGATION OF STATIC STRAIN-AGING AND SLOW STRAIN-RATE EMBRITTLEMENT IN COMMERCIAL PURITY TITANIUM BETWEEN 500 AND 900 K Ph.D. Thesis
Juan Ramon DonosoVillarroel 1976 202 p
Avail: Univ. Microfilms Order No. 77-6865

Static strain-aging and slow strain-rate embrittlement were investigated in a commercial purity titanium, containing 0.4 at. % oxygen as the principal interstitial impurity. Following prestraining, the specimens were immediately unloaded to about 10 MPa, and aged in situ between 555 and 630 K for various times. In this temperature interval, deformation twinning and serrated flow were not observed. The return of both the upper and the lower yield stresses were observed as functions of time. Under the conditions employed, the strain-aging response of titanium appeared to consist of three stages: (1) an interval in which the yield point return was small and time-independent, probably associated with an unloading effect; (2) a region in which the yield point return parameters rose to a saturation plateau at intermediate aging times; and (3) a region where a further increase in the upper yield point occurred after the saturation plateau. Dissert. Abstr.

N77-29267 Cornell Univ., Ithaca, N.Y.
DIFFRACTION STUDY OF THE STRUCTURE OF GRAIN BOUNDARIES AND DISLOCATIONS Ph.D. Thesis
Der-yang Guan 1976 118 p
Avail: Univ. Microfilms Order No. 77-8428

The development of electron and X-ray diffraction techniques for the study of the structure of grain boundaries and the core structure of dislocations is described. The structure factor of a square grid of screw dislocations was computed using the concept of the coincidence-site lattice and the displacement field of van der Merwe for the low angle (001) twist boundary. The calculations predict, for dislocations spaced dD apart, that the electron diffraction pattern from the dislocation array viewed at normal incidence consists of square arrays of reflections spaced 1/dD apart, centered around fcc reflections and in the same orientation as the square dislocation grid. No extra reflections were predicted around the reciprocal space origin. The calculated pattern of the hk0 reciprocal lattice plane showed excellent agreement with the observed electron diffraction pattern from a low angle twist boundary in gold. Dissert. Abstr.

N77-29268 Illinois Univ., Urbana-Champaign.
A UNIFIED PREDICTIVE TECHNIQUE FOR THE FATIGUE RESISTANCE OF CAST-FERROUS BASED METALS AND HIGH HARDNESS WROUGHT STEELS Ph.D. Thesis
Michael Roger Mitchell 1976 148 p
Avail: Univ. Microfilms Order No. 77-9108

A rational approach in predicting fatigue life is presented in which the effect of the microdiscontinuities, treated as notches, is taken into account. Dissert. Abstr.

N77-29269# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Metallurgy and Materials Science.
HYDROGEN SULFIDE STRESS CORROSION CRACKING IN MATERIALS FOR GEOTHERMAL POWER
R. F. Hehemann, A. R. Troiano, B. Abu-Khater, and S. Ferrigno 1976 34 p refs Presented at the Electrochem. Soc. Meeting, Las Vegas, Nev., 17 Oct. 1976
(Contract EY-76-S-02-2576)
(COO-2576-3; Conf-761057-2) Avail: NTIS

The performance of alloys used in geothermal power systems is evaluated. Alloys which are commercially available and those which have modified metallurgical structures and/or composition modifications were tested to determine the corrosive effects of the H2S and thermal environments in geothermal fluids. Hydrogen embrittlement and sulfide stress corrosion cracking were tested. Test results showing the effects of alloy composition, tempering temperatures, fluid temperature and salt content, and ageing on sulfide stress cracking are tabulated. ERA

N77-29270# Sandia Labs., Albuquerque, N. Mex.
CHARACTERIZATION OF METALLIZED ALUMINA: STRUCTURE
J. C. Swearengen and W. F. Chambers Nov. 1976 29 p refs
(Contract E(29-1)-789)
(SAND-76-0539) Avail: NTIS HC A03/MF A01

The composition and microstructure of a metallize-brazed alumina ceramic were characterized in support of the objective of determining in-situ mechanical properties for analytical prediction of braze joint performance. The volume fractions of glassy phase, alumina, and pores, and the composition of the glassy phase were each determined as functions of position within the metallize penetration zone. The metallizing elements penetrate to a depth of about 500 micrometers, and within this region the volume fraction of alumina remains constant at about 86 pct, while the fractions of glass and pore increase and decrease, respectively. Bulk samples having the measured compositions of the glassy phases were fabricated and subjected to the thermal excursions of the metallize-braze process. The crystalline phases produced during devitrification were identified by X-ray diffraction. The furnace atmosphere was observed to affect the crystallization, but the effect within the bulk ceramic is discounted. ERA

N77-29271# Sandia Labs., Albuquerque, N. Mex.
BLISTER FORMATION IN MULTIPLE ENERGY He+ IMPLANTED STAINLESS STEEL
K. L. Wilson (Sandia Labs., Livermore, Calif.), L. G. Haggmark (Sandia Labs., Livermore, Calif.), and R. A. Langley Dec. 1976 20 p refs Presented at the Intern. Symp. on Plasma Wall Interaction, Julich, West Germany, 18 Oct. 1976
(Contract E(29-1)-789)
(SAND-76-8688; Conf-761049-6) Avail: NTIS HC A02/MF A01

A series of multiple energy He(+) implantions was conducted on type 316 stainless steel at 575 and 775 K. Pre-implantations with 3, 10 and 15 keV He(+) were used to create a series of uniform helium concentrations to a depth of approximately 700 A. The effects of these pre-implantation helium concentrations on subsequent 20 keV bombardment were studied by gas re-emission and scanning electron microscopy. It was found that serious blistering and exfoliation would occur unless the pre-implantation helium concentration was approximately greater than 0.3 atom fraction from the surface to nearly the depth of the 20 keV implant. At this preimplant level, an interconnected pathway to the surface developed, allowing helium release without surface blistering. These results indicate that multiple energy implantation will still produce extensive surface deformation if the helium accumulates to a local critical concentration before an interconnected pathway develops. ERA

N77-29272# Brookhaven National Lab., Upton, N. Y. Dept. of Physics.
BASIC PHYSICS OF ONE-DIMENSIONAL METALS
V. J. Emery 1976 23 p refs Presented at the NATO Advanced Study Inst. on Chem. and Phys. of One-Dimensional Metals, Bolzano, 17 Aug. 1976
(Contract EY-76-C-02-0016)
(BNL-21878; Conf-760880-1) Avail: NTIS HC A02/MF A01

Largely nonmathematical qualitative lectures are given on the basic physics of nearly one-dimensional conductors. The main emphasis is placed on the properties of a purely one-dimensional electron gas. The effects of a real system having interchain coupling, impurities, a compressible lattice, lattice distortions, and phonon anomalies are discussed. ERA

N77-29273# Argonne National Lab., Ill.
BLISTERING PHENOMENA I: METALS AND ALLOYS
M. Kaminsky and S. K. Das 1976 17 p refs Presented at

the Conf. for Controlled Thermonucl. Fusion, Argonne, Ill., 9-13 Aug. 1976
(Contract W-31-109-eng-38)
(CONF-760882-1) Avail: NTIS HC A02/MF A01

A summary of the major parameters affecting the blistering process is given. Brief discussions of the blistering mechanisms are included. The following topics are described: (1) projectile target system; (2) projectile energy; (3) critical dose for blister formation, (4) effect of total dose; (5) dose rate; (6) target temperature; (7) crystallographic orientation of the irradiated surface; (8) models for blister formation; and (9) surface erosion of fusion reactor components by blistering. Author (ERA)

N77-29274# Colorado School of Mines, Golden.
LIQUID LITHIUM CORROSION RESEARCH Progress Report, 1 Apr. - 31 Dec. 1976
D. L. Olson and D. K. Matlock 1976 99 p refs
(Contract EY-76-S-02-2313)
(COO-2313-5) Avail: NTIS HC A05/MF A01

Stress enhanced lithium grain boundary penetration of iron was investigated under both tensile and compressive loads. Plastic deformation was found to control the penetration behavior regardless of the stress state that causes the plastic deformation. The penetration rate of stressed specimens is much larger than unstressed iron specimens. The creep rate was found to be rate controlling the penetration kinetics. The transformation of austenite to ferrite was noted in all the specimens corroded in liquid lithium. Contact potential measurements for the 340L stainless steel-liquid lithium test arrangement were measured and related to penetration kinetic data. Initial data illustrates that titanium is a superior nitrogen getter when compared to zirconium. A list of publications is included. ERA

N77-29275# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
FRACTURE TOUGHNESS AND FATIGUE PROPERTIES OF THE NEW ALUMINIUM ALLOY 7475-T76
W. G. J. Thart, A. Nederveen, E. Stoffels, and P. J. Tromp Nov. 1975 53 p refs
(Contract NIVR-1764)
(NLR-TR-75168-U) Avail: NTIS HC A04/MF A01

Residual tests were performed on 610 mm wide center cracked panels. During the tests, stable crack growth was filmed and crack opening displacements were measured. Fracture toughness was determined using the method of Feddersen. Flight simulation fatigue tests were carried out to investigate the crack propagation properties. A standardized load spectrum was used which was based on the gust load spectrum experienced by transport aircraft. Author (ESA)

N77-29276# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
THE SIGNIFICANCE OF CLADDING FOR FATIGUE OF ALUMINIUM ALLOYS IN AIRCRAFT STRUCTURES
J. Schijve, F. A. Jacobs, and P. J. Tromp 5 Sep. 1976 41 p refs
(Contract NIVR-1725)
(NLR-TR-76065-U) Avail: NTIS HC A03/MF A01

Flight simulation tests were carried out on sheet specimens notched by an open hole (Kt = 2.66). The material was 2024-T3 in three conditions: Alclad, bare, and chemically milled. The crack initiation period and the crack propagation period were considerably shorter for the Alclad material. The significance of the cladding, both for constant amplitude loading and variable amplitude loading, was analyzed. Information from the literature is summarized and practical aspects for aircraft application are indicated. Author (ESA)

N77-29277# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Abt. Korrosion.
THE VALIDITY OF THE CONSTANT STRAINING TEST METHOD IN THE SCC-RESEARCH COMPARED WITH CONVENTIONAL TESTING TECHNIQUES
Horst Buhl 23 Dec. 1976 18 p refs Sponsored by Bundesmin. fuer Forsch. u. Technol.
(DLR-FB-76-69) Avail: NTIS HC A02/MF A01; DFVLR, Cologne DM 9.50

The appearance of a minimum in the susceptibility to SCC/strain-rate-curves obtained by constant strain rate experiments was carefully examined and a relationship between the repassivation rate of the material under investigation and the position of this minimum established. For aluminum alloys the results of the constant strain rate experiments are not in complete agreement with the results of the conventional testing techniques. To explain this behavior further experiments have to be carried out. At this moment, it seems to be doubtful whether the constant strain rate testing technique is applicable to aluminum alloys. The results with titanium alloys and high alloyed chromium- and chromium-nickel stainless steels obtained with different testing techniques (constant strain rate and constant load), are in very good agreement with each other. Author (ESA)

N77-29278# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
AMBIENT TEMPERATURE CRACK GROWTH IN TITANIUM ALLOYS AND ITS SIGNIFICANCE FOR AIRCRAFT STRUCTURES
R. J. H. Wanhill Mar. 1976 62 p refs Submitted for publication
(NLR-MP-76008-U) Avail: NTIS HC A04/MF A01

The influence of microstructure, processing, heat treatment, and fracture modes on ambient temperature cracking in titanium alloys is reviewed in order to predict ambient temperature cracking which may occur in titanium alloy aircraft structures. Selection of materials for aircraft structural applications, basing the selection on both conventional mechanical properties and damage tolerance criteria, is discussed. Author (ESA)

N77-29279# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Werkstoff-Forschung.
FRACTURE TOUGHNESS DETERMINATION OF THE ALUMINIUM ALLOY 7475-T 7351 WITH DIFFERENT SPECIMEN SIZES
Dietrich Munz 15 Feb. 1977 49 p refs Sponsored by Deut. Forschungsgemeinschaft
(DLR-FB-77-04) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 20.70

Fracture toughness was determined with 3-point-bend specimens of different sizes. The stress intensity factor K increases with increasing crack extension independent of the size of the specimens at a 5 % secant load. Therefore K at a crack extension of 0.1 mm is independent of specimen size, whereas KI increases with increasing width. Using a variable secant adjusted to the specimen size, a size independent stress intensity factor at the onset of unstable crack extension under plane strain can be determined. Thus the specimen size required by ASTM E 399 can be reduced considerably. Author (ESA)

N77-29280# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
A COMPARISON OF FATIGUE CRACK PROPAGATION RATES IN CM002 (UNCLAD RR58) ALUMINIUM ALLOY IMMERSED IN JET FUEL AND A FUEL SIMULANT
F. E. Keates and R. F. Mousley London Aeron. Res. Council 1977 20 p refs Supersedes RAE-TR-76047; ARC-36892
(ARC-CP-1365; RAE-TR-76047; ARC-36892) Avail: NTIS HC A02/MF A01; HMSO £1.50; PHI $5.80

Fatigue crack propagation tests were conducted on CM002 (unclad RR58) aluminum alloy sheet under a flight-by-flight loading sequence. The specimens were immersed in jet fuel at 70 C and in fuel simulant at 90 C to simulate conditions in Concorde service and in the Concorde major fatigue test respectively. No large difference in crack propagation was observed. Comparison with results of similar tests in air at room temperature and at 90 C suggested that the presence of fuel or fuel simulant did not in itself materially affect crack growth. Author (ESA)

N77-29281# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
EFFECT OF INTERSPERSED PERIODS OF HEATING ON FATIGUE CRACK INITIATION AND PROPAGATION IN CM001 (RR58) CLAD SHEET
F. E. Kiddle London Aeron. Res. Council 1977 33 p refs Supersedes RAE-TR-76092; ARC-37041

(ARC-CP-1366; RAE-TR-76092; ARC-37041) Avail: NTIS HC A03/MF A01; HMSO £2; PHI $7.65

Fatigue tests were conducted to study the effect of interspersed periods of heating on the initiation and early growth of cracks from holes in CM001 (RR58) clad aluminum alloy sheet and also on later stages of crack propagation. Interspersed heating reduced the lives to initiation and grow cracks to 2 mm and this is attributed to the softening of strain hardened material at the crack tip, but no effect was observed for longer crack lengths. When load was applied during the periods of heating creep redistribution of local stress retarded the growth of short and long cracks. Further work is underway to investigate fatigue-heat interactions under different load-temperature sequences, other forms of material, and over a wider range of crack lengths. Author (ESA)

N77-29282# Northrop Corp., Hawthorne, Calif. Aircraft Div.
FUNDAMENTAL INVESTIGATION OF ANODIC OXIDE FILMS ON ALUMINUM ALLOYS AS A SURFACE PREPARATION FOR ADHESIVE BONDING Final Report, 1 Apr. 1975 - 30 Jun. 1976
R. E. Herfert Wright-Patterson AFB, Ohio AFML Aug. 1976 112 p refs
(Contract F33615-75-C-5721; AF Proj. 7342)
(AD-A038068; NOR-76-101; AFML-TR-76-142) Avail: NTIS HC A05/MF A01 CSCL 11/3

This study was structured to define the physical, chemical, and mechanical characteristics of anodized films by selecting widely differing anodic processes, systematically varying these processes, and carefully characterizing the resultant surfaces using the most advanced instrumental techniques. After defining the structure and character of the anodic film from the surface to the metal interface, a comparison of the relative stability of these surfaces was made by defining the point at which breakdown or hydration of the film occurred in salt spray and humid environments. Five distinct anodic systems were chosen for study in this program. These represented two porous systems, phosphoric acid and chromic acid, and three barrier layer systems: (1) ammonium chromate, (2) potassium/lithium nitrate eutectic salt, and (3) ammonium pentaborate in ethylene glycol. In each anodic system, electrical properties were recorded during anodization. Surfaces of each anodic coating were analyzed using electron diffraction to determine crystal structure, Auger electron spectroscopy to determine the chemistry, and scanning electron microscopy to characterize the thickness and morphology of the oxide. GRA

N77-29283# California Univ., Los Angeles. Dept. of Materials.
STRAIN ENERGY CONSIDERATION OF MARTENSITIC TRANSFORMATION IN TITANIUM ALLOYS
M. Shibata and Kanji Ono Mar. 1977 24 p refs
(Contract N00014-75-C-0889)
(AD-A038398; TR-3) Avail: NTIS HC A02/MF A01 CSCL 11/6

Total strain energy of bcc to hcp martensitic transformation in several titanium alloys has been evaluated. Its minimum is assumed to dictate the characteristics of a transformation product and various features of Ti alloy martensites have been deduced. This analysis considered both elastic strain energy originated from the transformation strain and plastic relaxation strain in relief of high internal stresses. GRA

N77-29284# Del West Associates, Inc., Woodland Hills, Calif.
RESEARCH TOWARD DEVELOPING AN UNDERSTANDING OF CRYSTALLOGRAPHIC TEXTURE ON MECHANICAL PROPERTIES OF TITANIUM ALLOYS Final Technical Report, Jun. 1974 - Aug. 1976
A. W. Sommer and M. Creager Jan. 1977 228 p refs
(Contract F33615-74-C-5107)
(AD-A038332; DW12-1; AFML-TR-76-222) Avail: NTIS HC A11/MF A01 CSCL 11/6

Research was conducted during this effort to define the relationship(s) between mechanical properties and crystallographic texture development in three commonly used alpha - gamma Ti alloy compositions. Texture development was monitored during the conversion of production ingot stock to one quarter inch thick rolled plate as a function of thermomechanical processing. The three alloy compositions were: 6Al-4V Ti ELIGrade, 6Al-4V Ti Standard Grade, and 6Al-2Sn-4Zr-6Mo Ti. Sufficient quantities of one specific textural type, basal transverse, were produced for all three compositions to permit extensive mechanical and fracture property testing at room and elevated temperature as a function of product orientation. Material properties evaluated were: elastic modulus, monotonic stress: strain behavior, cyclic stress: strain behavior, notched and unnotched fatigue, and fracture toughness (Resistance Curves). GRA

N77-29285# Army Materials and Mechanics Research Center, Watertown, Mass.
WARM-DIE-FORMING OF BETA TITANIUM ALLOY STRIP Final Report
Stuart V. Arnold and Paul J. Doyle Dec. 1976 28 p
(AD-A038848; AMMRC-TR-76-41) Avail: NTIS HC A03/MF A01 CSCL 11/6

Continuous strip of Ti-8Mo-8V-2Fe-3Al was investigated for possible application in the nose cap for the main rotor blade of the Heavy Lift Helicopter as part of the Advanced Technology Component Program. Aging response of strip solutionized in a continuous vacuum annealing furnace and subsequently cold rolled was determined as functions of time and temperature for several levels of cold reduction. Tensile and fatigue properties of strip produced by selected practices were measured. Feasibility of creep forming solutionized-and-cold-rolled strip to nose cap contours during aging was explored. Warm die forming and aging of strip to those same contours was demonstrated. Author (GRA)

N77-29286# Martin Marietta Corp., Baltimore, Md.
GRAIN BOUNDARY SEGREGATION OF A Al-Zn-Mg TERNARY ALLOY Interim Technical Report
J. M. Chen, T. S. Sun, R. K. Viswanadham, and J. A. Green Apr. 1977 35 p refs Submitted for publication
(Contract N00014-74-C-0277; NR Proj. 031-716)
(AD-A039014; MML-TR-77-29C; TR-4) Avail: NTIS HC A03/MF A01 CSCL 11/6

Auger electron spectroscopy (AES) has been used to measure the grain boundary concentration profiles of alloy additions in a Al-5.5% Zn-2.5% Mg ternary. The AES depth profiles show marked segregation of Mg and Zn to the grain boundary, in contrast to that reported previously on similar Al alloys. It is found that this apparent contradiction can be resolved by exploiting the plasmon-loss features of the AES spectra to help elucidate the grain boundary segregation. With the AES/plasmon-loss measurements, one can determine not only the concentration of Mg and Zn at the grain boundary, but also the metallurgical environments surrounding the alloy additions. It is shown that, for over-aged specimens of the Al alloy, only a fraction of the total Mg at the grain boundary is incorporated in $MgZn_2$ precipitates, the remainder being segregated to within a few atomic layers of the boundary. Author (GRA)

N77-29287# Rockwell International Corp., Los Angeles, Calif. B-1 Div.
FRACTURE MECHANICS EVALUATION OF B-1 MATERIALS. VOLUME 1: TEXT Documentary Report, Dec. 1970 - Apr. 1975
R. Ferguson and R. C. Berryman Wright-Patterson AFB, Ohio AFML Oct. 1976 743 p refs 2 Vol.
(Contract F33657-70-C-0800)
(AD-A039883; NA-74-862-Vol-1; AFML-TR-76-137-Vol-1) Avail: NTIS HC A99/MF A01 CSCL 01/3

A total of 1,764 fracture mechanics tests were conducted on fourteen alloys to develop property data for use in the B-1 design. Tests were performed on aluminum alloys 2024, 2124, 2219, 7049, 7050, 7075 and 7175; titanium alloy Ti-6Al-4V; steel alloys 9Ni-4Co-.20C, 9Ni-4Co-.30c and 300M; corrosion resistant steel PH13-8Mo; nickel alloy Inconel 718; and nickel-cobalt alloy MP 35 N. The effects of product form, heat-to-heat variability, grain orientation, and heat treat condition on fracture behavior were investigated. In addition, the fracture properties of welds in Ti-6Al-4V, PH13-8Mo and 9-4-.20 alloys and of diffusion bonds in Ti-6Al-4V were determined. Testing variables were temperature, specimen thickness, environment, cyclic frequency and R factor for the da/dN tests. The results of the tests are presented in tables and graphs in detailed and

summarized forms. The effects of the various material and testing variables on fracture behavior are discussed. GRA

N77-29288# Rockwell International Corp., Los Angeles, Calif. B-1 Div.
FRACTURE MECHANICS EVALUATION OF B-1 MATERIALS. VOLUME 2: FATIGUE CRACK GROWTH DATA Documentary Report, Dec. 1970 - Apr. 1975
R. Ferguson and R. C. Berryman Wright-Patterson AFB, Ohio AFML Oct. 1976 597 p 2 Vol.
(Contract F33657-70-C-0800)
(AD-A039785; NA-74-862-Vol-2; AFML-TR-76-137-Vol-2) Avail: NTIS HC A25/MF A01 CSCL 01/3

A total of 1,764 fracture mechanics tests were conducted on fourteen alloys to develop property data for use in the B-1 design. Tests were performed on aluminum alloys 2024, 2124, 2219, 7049, 7050, 7075 and 7175; titanium alloy Ti-6Al-4V; steel alloys 9Ni-4Co-.20C, 9Ni-4Co-.30c and 300M; corrosion resistant steel PH13-8Mo; nickel alloy Inconel 718; and nickel-cobalt alloy MP 35N. The effects of product form, heat-to-heat variability, grain orientation, and heat treat condition on fracture behavior were investigated. The results of the tests are presented in tables and graphs in detailed and summarized forms. The effects of the various material and testing variables on fracture behavior are discussed. GRA

N77-29289# Colorado State Univ., Fort Collins. Dept. of Chemistry.
VIBRATIONAL SPECTRA OF TRANSITION METAL HEXAFLUORIDE CRYSTALS. 2: TWO-PARTICLE AND MIXED CRYSTAL SPECTRA AS TECHNIQUES FOR DETERMINATION OF DENSITIES OF STATES
E. Bernstein and G. R. Meredith Apr. 1977 45 p refs
(Contract N00014-75-C-1179)
(AD-A039857; TR-13) Avail: NTIS HC A03/MF A01 CSCL 20/2

In this document two techniques for obtaining densities of exciton states are discussed: heavily doped mixed crystals and two-particle overtone and combination bands. It is demonstrated through Raman spectra and calculations that nu(i) + nu(1) combination bands yield very nearly true density of states functions for nu(i) in the case for which nu(1) is essentially dispersionless. The mixed crystal method for density of states determinations is compared to the combination band technique, and approximate mixed crystal concentrations appropriate for such studies can be calibrated for individual bands. It is pointed out that the overtone method, whenever applicable, is both simpler and more accurate for exciton state studies. Detailed analyses of nu(1) and 2nu(1) show that the major contribution to overtone intensity comes from the second order polarizability derivative and not anharmonic contributions. Author (GRA)

N77-29290# Colorado State Univ., Fort Collins. Dept. of Chemistry.
VIBRATIONAL SPECTRA OF TRANSITION METAL HEXAFLUORIDE CRYSTALS. 1: ORTHORHOMBRIC MoF6, WF6, AND UF6 NEAT CRYSTALS
E. Bernstein and G. R. Meredith Apr. 1977 45 p refs Submitted for publication
(Contract N00014-75-C-1179; NR Proj. 056-607)
(AD-A039765; TR-1215) Avail: NTIS HC A03/MF A01 CSCL 20/2

Neat crystal Raman spectra of orthorhombic MoF6, WF6, and UF6 are presented and discussed. The neat crystal spectra are interpreted in terms of an internal-external mode separation and a conventional factor group analysis. In general, these data lead to four essential conclusions concerning hexafluoride crystals: (a) Fermi resonance plays an important role in producing the observed energy and intensity differences in this series; (b) k = 0 exciton structures are remarkably similar in the three crystals; (c) similarities and differences between these solids can be directly correlated with molecular parameters such as dipole derivatives, polarizabilities, etc.; and (d) phonons (external modes) can be neatly separated into rotational and translational normal modes. GRA

N77-29291# Colorado State Univ., Fort Collins. Dept. of Chemistry.
VIBRATIONAL SPECTRA OF TRANSITION METAL HEXAFLUORIDE CRYSTALS. 3: EXCITATION BAND STRUCTURES OF MoF6, WF6 AND UF6
E. Bernstein and G. R. Meredith Apr. 1977 55 p refs Submitted for publication
(Contract N00014-75-C-1179; NR Proj. 056-607)
(AD-A039793; TR-14) Avail: NTIS HC A04/MF A01 CSCL 20/2

This paper presents the overall vibrational band structure of MF6 crystals based on the previously discussed two-particle, heavily doped mixed crystal, and neat crystal data in addition to dilute mixed crystal studies. Calculations of nu(2) and nu(5) bands based on a quadrupole-quadrupole intermolecular interaction model are determined to be in substantial agreement with the observations. The nu(1) bands are discussed in detail for a series of concentration studies and it is possible to demonstrate that MoF6 and WF6 conform to the ideal mixed crystal model whereas crystals containing UF6 do not. A consistent picture of gas-to-crystal shifts, resonance interactions, band shapes and structures, densities of exciton states, Fermi resonance, and simple multipolar interaction models emerges from these studies. GRA

N77-29292# Army Materials and Mechanics Research Center, Watertown, Mass.
YIELD STRENGTH PHENOMENON IN Ti-6Al-4V Final Report
Paul J. Fopiano and Stephen A. Oliver Apr. 1977 12 p
(AD-A040931) Avail: NTIS HC A02/MF A01 CSCL 11/6

The titanium alloy Ti-6Al-4V has a very low yield strength (LYS) when water quenched from 850 C. This LYS is often attributed to the deformation-induced transformation of retained beta to martensite. This report gives evidence that it is not accurate to postulate a TRIP (transformation-induced plasticity) type of mechanism to explain the LYS in the 6-4 alloy. Author (GRA)

N77-29293# University Coll. of North Wales, Bangor. School of Physical and Molecular Sciences.
PREPARATION AND PROPERTIES OF A STABLE METALLIC FERROFLUID Final Technical Report, Dec. 1975 - Dec. 1976
S. W. Charles and J. Popplewell Sep. 1976 39 p refs
(Grant DA-ERO-75-G-025; DA Proj. 1T1-61102-B-32D)
(AD-A036215) Avail: NTIS HC A03/MF A01 CSCL 20/3

The aim of this research work has been to obtain a suspension of small single domain ferromagnetic particles in a metallic carrier stable in high magnetic fields and over a temperature range suitable for its application in an energy convertor. An ultra stable suspension of iron particles in mercury containing 0.7 wt % of tin and approximately 2 wt % of sodium has been produced. This fluid is stable up to 420K and in zero magnetic field over the period of time during which measurements have been made, i.e. approximately one year. To date measurements have not been made above 420K. Theory predicts that the fluid as described above would be sufficiently stable in a magnetic field gradient of 100,000 oersted/cm to enable it to be used in an energy converter. However, initial experiments have shown that the effective rate of diffusion of iron particles under the influence of such a field gradient is many orders of magnitude greater than predicted. GRA

N77-29294# Illinois Univ., Urbana-Champaign. Dept. of Mechanical and Industrial Engineering.
MACHINE CASTING OF FERROUS ALLOYS Semiannual Technical Report, 1 Apr. - 30 Sep. 1976
R. Mehrabian, D. G. Backman, Y. V. Murty, G. J. Abbaschian, and S. D. E. Ramati Jan. 1977 63 p refs
(Contract DAAG46-76-C-0023; ARPA Order 2267)
(AD-A040651; AMMRC-CTR-77-11; SATR-2) Avail: NTIS HC A04/MF A01 CSCL 11/6

This report covers work carried out in the past six months on the following subjects. (1) The various casting systems built during the first six months of the contract period were modified and improved. A new technique was developed for the production of Rheocast ingots of low temperature alloys semi-continuously. A 400 ton Lester cold chamber horizontal die casting machine was acquired and is being installed for future experiments. (2) The important variables in a continuous slurry producer, a

Rheocasting apparatus, were identified and the relationship between these variables and the structure of the primary solid particles in slurries of Sn-15%Pb alloy and X-40 cobalt base superalloy was determined. These structures were compared to conventional dendritic structures solidified under identical average cooling rates. (3) The relationship between gating systems, process variables, and mold filling characteristics in a casting machine were established through transparent mold filling studies using dimensionless numbers. GRA

N77-29295# Case Western Reserve Univ., Cleveland, Ohio.
INFLUENCE OF GRAIN REFINEMENT ON THE STRUCTURE AND PROPERTIES OF CAST NICKEL-BASE SUPERALLOY TURBINE COMPONENTS Final Report, 10 Sep. 1973 - 15 May 1977
A. F. Denzine, T. A. Kolakowski, W. M. Matlock, and J. F. Wallace May 1977 105 p refs
(Contract DAAG46-74-C-0009)
(AD-A040246; USAAVSCOM-77-27; AMMRC-CTR-77-15) Avail: NTIS HC A06/MF A01 CSCL 11/6

The influence of refinement of the cast grains on the mechanical properties of three nickel base superalloys (713LC, MAR-M-246 and C103) was determined. The investigation was conducted because improvements in the fatigue properties of integrally cast rotors for helicopters was desired. Grain refinement of all three alloys was accomplished by a controlled thermal cycling technique together with a boron addition to the melt. This refinement practice was successfully adapted to a production rotor casting. This grain refinement increased by a factor of 2 to 4 the number of cycles to failure in low cycle fatigue of 713LC and MAR-M-246. The fatigue behavior of C103 was insensitive to grain size. The yield strength of 713LC and MAR-M-246 was increased 10 ksi but the tensile strength and ductility slightly decreased by grain refinement. The 1800 F stress rupture properties of the refined alloys were slightly superior to the unrefined alloys at high stress levels and equal to or slightly inferior at low stress levels. At 1850 F and lower stress levels, the stress rupture properties of MAR-M-246 were somewhat reduced compared to the unrefined structure. Author (GRA)

N77-29296# Boeing Commercial Airplane Co., Seattle, Wash.
HIGH INTEGRITY FORGING OF ALUMINUM AND TITANIUM ALLOYS Final Report
M. V. Hyatt, D. H. Pasley, I. Goodlet (Aluminum Co. of Am., Cleveland), and C. P. Yohn (Aluminum Co. of Am., Cleveland) May 1977 266 p refs Prepared in cooperation with TiTech Intern., Romona, Calif.
(Contract F33615-71-C-1693)
(AD-A041007; D6-44423) Avail: NTIS HC A12/MF A01 CSCL 11/6

The primary objective of this program was to establish the mechanical property and economic advantage of precision aluminum alloy and titanium alloy aerospace structural forging. The mechanical and fracture properties of the aluminum precision forging were comparable to the aluminum die forgings except at rib flange intersects where highly distorted grain flow and possible defects caused lower fatigue properties. These effects could probably be eliminated by changes in die design and/or preform design. The titanium portion of the program was redirected to the use of titanium castings instead of isothermal precision titanium forgings. This was done because (1) the calculated minimum web thickness was 0.185 in. and the 0.05- to 0.07-in. thickness per drawing could not be achieved, which would require 100% machining, minimizing the potential cost savings; (2) the knockout system was not adequate and would require modification to replace the single knockout system with two knockout stems. The titanium casting though comparable in static strength to conventional titanium die forgings had less than 10% of the fatigue life of the forging. Other design concepts may have improved the fatigue performance. The hourly charges for machining both the aluminum and titanium forgings and castings are provided. Author (GRA)

N77-29297# Battelle Columbus Labs., Ohio.
HANDBOOK OF INTERNATIONAL ALLOY COMPOSITIONS AND DESIGNATIONS. VOLUME 1, TITANIUM
Harold Hucek and Marshal J. Wahl Nov. 1976 241 p refs
(Contract DSA900-76-C-2471)
(AD-A036433; MCIC-HB-09-Vol-1) Avail: NTIS HC A11/MF A01 CSCL 11/6

The handbook was compiled from data collected from many sources in an effort to bridge the nomenclature gap on titanium materials produced and used in various countries of the world. Its primary purpose and emphasis is to conveniently interrelate the alloy designations and standards of one country with the alloy designations, compositions, and standards of other countries for titanium materials. In addition to equating chemical compositions of the world's titanium alloys, the handbook relates compositions to product forms, standards, producing companies, alloy types, common names, and applications, and it also lists some basic physical and mechanical properties for the better-known alloys. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N77-29298 Rutgers - The State Univ., New Brunswick, N. J.
POTENTIOMETRIC AND FLUORESCENT PROBE STUDIES HYDROLYZED COPOLYMERS OF ALKYL VINYL ETHERS AND MALEIC ANHYDRIDE Ph.D. Thesis
Marcia Shaindel Schlesinger 1976 148 p
Avail: Univ. Microfilms Order No. 77-7279

The effects of the alkyl group size and counterions on the aqueous solution properties of hydrolyzed 1:1 copolymers of alkyl vinyl ethers and maleic anhydride were studied. Ethyl, butyl, pentyl, hexyl and octyl groups were used as well as lithium, sodium and tetramethylammonium (TMA) counterions. A derive of dansyl chloride was covalently attached to the copolymers, and the corrected emissions spectra were used to monitor the random coil conformation transitions. Studies indicated that TMA has a direct hydrophobic stabilizing effect on the hypercoil form at low degrees of ionization, alpha, however, the lithium ion has an indirect stabilizing effect at high alpha by virtue of its specific site binding to the more hydrophobic polyacids. Dissert. Abstr.

N77-29299 Maine Univ., Orono.
ADHESIVE-VEHICLE MIGRATION IN AN AQUEOUS PIGMENTED COATING
A. Krishnagopalan 1976 128 p
Avail: Univ. Microfilms Order No. 77-8327

The distribution of adhesive and vehicle in a surface coating and in the base paper was investigated using styrene butadiene latex of standard formulation (Dow 638) tagged with osmium, and potassium chloride was the tracer for the aqueous vehicle. The distribution of tracers after coating a bleached hardwood/softwood Kraft paper was measured as a function of depth with an electron probe microanalyzer. The distribution of clay using aluminum as the characterising element served to define the coating/paper interface. Coating variables included total solids, drying conditions, and the sizing of paper. High solids content of the coating color led to more binder retention in the coating of unsized paper. A minimum of 20% of the total binder used was found to migrate into a sized sheet, while in the case of unsized paper this was as high as 70%. Water penetration in all cases was more than 70%. Dissert. Abstr.

N77-29300 Illinois Univ., Urbana-Champaign.
STRUCTURE-PROPERTY RELATIONS IN SILICATE GLASSES Ph.D. Thesis
Shridhar Balkrishna Joshi 1976 237 p
Avail: Univ. Microfilms Order No. 77-9045

One hundred and ten glasses were melted and their properties like density, refractive index, electrical conductivity with temperature, durability, Littleton's softening point, water content, and some crystallization characteristics were measured. About two hundred glasses along with their properties were compiled and used for the purpose of analysis along with the data gathered on the glasses melted in the laboratory. The range of the compositions covered is fairly wide. The oxides covered in this work are silicon dioxide, aluminum oxide, lithium oxide, sodium

oxide, potassium oxide, magnesium oxide, calcium oxide, strontium oxide, barium oxide, zinc oxide and lead oxide. Based on the analysis of the responses of these glasses a structure model for silicate glasses is proposed. It is based on the consideration of a ring formed by the silicon. Dissert. Abstr.

N77-29301 Rutgers - The State Univ., New Brunswick, N. J.
DEVELOPMENT OF HIGH DIELECTRIC CONSTANT TEMPERATURE STABLE CERAMIC MATERIALS Ph.D. Thesis
Hugh Caldwell Johnson 1976 208 p
Avail: Univ. Microfilms Order No. 77-7237

Two ceramic systems were investigated in order to develop a high K (K> 50) temperature stable TC sub k + or minus 100 ppm/C) dielectric material. The first system was based on the CaTiO3-MgTiO3-La2Ti2O7 ternary system, and the second system involved adding small amounts of a lossy glass to a crystalline matrix material based on the CaTiO3-MgTiO3 binary system. It was found that the ternary alone did not lend itself to development of the objectives of the thesis. However, one composition, designated L12 and consisting of 61.8 mole % CaTiO3, 12.5 mole % MgTiO3, and 25.7 mole % La2Ti2O7, closely realized the electrical requirements of the investigation, and had a K of 81, a TC sub k of -308 ppm/C, and losses between 0.00001 and 0.00010 when measured between -40 and +85 C at 1 kHz. Ionic substitutions were made in this composition, and it was found that replacement of the Ti in the La2Ti2O7 by Sn successfully moved the electrical properties toward the desired values. Dissert. Abstr.

N77-29302 Princeton Univ., N. J.
CASE STUDIES IN THE RELAXATIONAL BEHAVIOR OF AMORPHOUS POLYMERS Ph.D. Thesis
Carlos Alberto Glandt 1977 233 p
Avail: Univ. Microfilms Order No. 77-7361

Four cases of molecular relaxations were studied from quite distinct aspects. A low frequency dynamic mechanical technique, namely Torsional Braid Analysis (TBA), was consistently used in all four cases. A study on the cure and transitions of an epoxy-imidazole system is presented. The process of cure was monitored by means of the mechanical properties of a glass braid-polymer composite (TBA specimen). Findings are reported regarding the t sub ll (less than Tg) transition in amorphous polystyrene. The effect of dispersity on the T sub ll relaxation was investigated for a systematic variation of molecular weight. Thermomechanical and morphological studies of rubber modified epoxy systems are reported. A very effective low frequency method was used, namely thermally stimulated discharge of a polymer electret to resolve a presumed loss doublet in the thermomechanical spectrum. The polymer under investigation was a polyalkoxy phosphazene copolymer, which was found to exhibit peaks of two relaxation mechanisms at 133 and 118 K. Dissert. Abstr.

N77-29303 Rutgers - The State Univ., New Brunswick, N. J.
THE PRESSURE DEPENDENCE OF THE TORSIONAL SHEAR BEHAVIOR OF POLYMERS Ph.D. Thesis
Alfred Anthony Silano 1976 201 p
Avail: Univ. Microfilms Order No. 77-7282

A torsion testing apparatus was developed to study the effects of hydrostatic pressure on the shear stress-strain behavior of polymers from atmospheric pressure up to 7 kilobars. Several important modifications which distinguish the device from other designs were made. Twist rate was automatically maintained at constant levels throughout a test by feedback amplifier circuitry. Loading torque was detected by a load cell mounted within the torque shaft untouched by the pressure medium and unaffected by friction in the seals. Rate of twist was sensed internally by an electrically activated contact point mounted on the rotating end of the specimen and externally by a rotary variable differential transformer. Both torque and twist signals were monitored and recorded rapidly by an integrated electronic system. Dissert. Abstr.

N77-29304 Utah Univ., Salt Lake City.
MOLECULAR BEHAVIOR OF AMORPHOUS, GLASSY POLYMERS UNDER TENSILE STRESS, FATIGUE AND CRAZING CONDITIONS Ph.D. Thesis
Suneet Kumar Sikka 1976 336 p
Avail: Univ. Microfilms Order No. 77-8451

Molecular behavior of two commercially important glassy polymers, polystyrene and polycarbonate, was studied under tensile stress, cyclic fatigue, and in crazing conditions. The primary technique employed is a new Dynamic Infrared Spectroscopy using both the conventional Perkin Elmer spectrophotometer, as well as the latest computer-equipped Fourier Transform spectrometer. This dynamic technique was supplemented by standard characterizations, viz., X-ray scattering, dynamic mechanical measurements, tensile testing, density measurements and optical and scanning electron microscopies. Also, X-ray scattering under stress was used for the first time for these glassy polymers. The viability of the new dynamic infrared technique to studying the molecular behavior in glassy polymers under varying tensile stress, fatigue and crazing conditions is shown. An understanding of this molecular behavior is vital to explain and improve end use properties. Dissert. Abstr.

N77-29305# Cornell Univ., Ithaca, N.Y. Dept. of Materials Science and Engineering.
REDUCTION OF MIXED SPINEL OXIDES Progress Report, 1 Apr. 1976 - 31 Mar. 1977
L. C. DeVonghe Dec. 1976 7 p refs
(Contract E(11-1)-2584)
(COO-2584-2) Avail: NTIS HC A02/MF A01

Dense nickel ferrites, pure and alloyed with alumina were reduced in hydrogen at 1000 C for times up to 2 hours. The presence of alumina in solid solution significantly affects the reduction scale morphology in that it restricts pore formation to grain boundaries. The rates of scale formation reflect these micromorphological differences, indicating that, while initially the rate of reduction of the alumina doped material is lower, at long times, the alumina containing material is actually more reducible. Dense cobalt ferrites showed a different reduction behavior than nickel ferrites, in that a dense metallic alloy layer is formed early in the reduction process. Progress is also reported in the area of sample preparation and functioning of the thermobalance. ERA

N77-29306# California Univ., Berkeley. Lawrence Berkeley Lab.
CRACK GROWTH IN GLASS SUBJECTED TO CONTROLLED IMPACTS
W. E. Snowden Nov. 1976 285 p refs
(Contract W-7405-eng-48)
(LBL-5752) Avail: NTIS HC A13/MF A01

Crack growth in borosilicate glass plates subjected to controlled impacts was studied using high-speed streak photography. Target plates containing thermally-induced pre-cracks were impacted using a magnetic hammer system capable of providing impacts at known velocities and times. The maximum stress in the targets following impact increased approximately linearly with the velocity of the aluminum flyers. The duration of the stress waves generated on impact varied with the flyer thickness. The relation between stress pulse characteristics and crack growth was examined in an attempt to establish a criterion for fracture by stress waves. Critical impact velocities required for crack growth were determined for a range of experimental conditions. Corresponding stress histories at the crack front position in the target plates were calculated using finite-difference computer codes. ERA

N77-29307# Naval Research Lab., Washington, D. C.
MODIFIED SMOLDERING TEST OF URETHANE FOAMS USED IN ANECHOIC CHAMBERS Interim Report
P. A. Tatem, P. D. Marshall, and F. W. Williams 9 Mar. 1977 17 p
(AD-A038439) Avail: NTIS HC A02/MF A01 CSCL 11/9

A program is under way at the Naval Research Laboratory to develop small-scale laboratory fire tests that will predict more accurately the behavior of Class A materials in fires. After development of five small-scale performance specifications for assessing the hazard of carbon-impregnated polyurethane foam, samples of the materials were installed in a large-scale fire test facility to determine the scaling parameters applicable to the foam. The knowledge gained from the large-scale tests under different experimental conditions and with several polyether and polyester foams has been used to scale down to a laboratory

test that dynamically measures the expected behavior of the foam in a scaled situation. Author (GRA)

N77-29308# Oakland Univ., Rochester, Mich. Dept. of Chemistry.

THE EFFECT OF LANTHANIDE SHIFT REAGENTS ON THE PROTON NMR SPECTRA OF VINYL POLYMERS Final Report, Jun. 1974 - Feb. 1976

Karl Arrington and R. Craig Taylor 11 Mar. 1977 29 p refs (Contract N00014-75-C-1004; NR Proj. 053-586)
(AD-A038086) Avail: NTIS HC A03/MF A01 CSCL 07/4

An attempt was made to characterize the stereoregularity of vinyl polymers using paramagnetic lanthanide shift reagents in conjunction with a 60 MHz nmr spectrometer. Eu(fod)3 and Eu(fod)3-d27 were the reagents of choice based on a combination of line broadening effects and the magnitude of the induced chemical shift of the t-butyl protons in poly(t-butyl-methacrylate). Isotactic and Atactic samples of poly(methylmethacrylate) were investigated, but the use of the aforementioned shift reagents did not significantly improve the spectral resolution of triad sequences in these polymers. It was concluded that lanthanide shift reagents, when used in conjunction with a 60 MHz instrument, do not yield any additional information about microstructures of vinyl polymers. Author (GRA)

N77-29309# Drexel Univ., Philadelphia, Pa. Dept. of Mechanical Engineering and Mechanics.

DYNAMIC BEHAVIOR OF LAMINATED POLYMERIC MATRIX COMPOSITES Annual Report, 15 Mar. 1974 - 15 Mar. 1975

Richard W. Mortimer and Pei C. Chou Wright-Patterson AFB, Ohio AFML Jul. 1976 58 p refs
(Contract F33615-73-C-5102)
(AD-A038067; AFML-TR-76-127) Avail: NTIS HC A04/MF A01 CSCL 21/5

The primary goal of this two-year program is to study, numerically, and experimentally, the dynamic response of idealized laminated graphite-epoxy fan blades subjected to impact loads. The blade is simulated by a flat plate. Two impact cases are studied: one is the inplane impact, the other is the shear-bending impact. This report includes results of the theoretical and experimental predictions of wave velocities and strain histories for the cases of in-plane and shear-bending impact of aluminum, graphite-epoxy cross-ply, and graphite epoxy angle-ply plates. In addition, the status of the program to compute local responses (using the finite-difference code HEMP) and structural responses (using NASTRAN) of laminated structures is presented. Finally, preliminary results of an impact parametric study (utilizing NASTRAN) involving the impact of a laminated beam structure are presented. GRA

N77-29310# Air Force Materials Lab., Wright-Patterson AFB, Ohio.

THE MECHANISMS OF ELEVATED TEMPERATURE PROPERTY LOSSES IN HIGH PERFORMANCE STRUCTURAL EPOXY RESIN MATRIX MATERIALS AFTER EXPOSURES TO HIGH HUMIDTY ENVIRONMENTS Technical Report, Jun. 1974 - Jul 1976

Charles Edward Browning Mar. 1977 187 p refs
(AD-A039754; AFML-TR-76-153) Avail: NTIS HC A09/MF A01 CSCL 11/4

The objective of this research program was the determination of the mechanisms by which epoxy resins utilized in high performance composites and adhesives exhibit losses in their elevated temperature properties as a result of exposure to a humid environment. The study specifically considered an epoxy resin formulation that is characteristic of a variety of composite and adhesive systems. The moisture absorption and diffusion characteristics of this resin system were first investigated as a function of simple humidity environments and simulated real-life environments which included therm spikes. In addition, the effect of absorbed moisture on the resin system's glass transition temperature, Tg, was determined as a function of both simple humidity and real-life exposures. This was followed by a study into the tensile and creep behavior of the epoxy resin as a function of absorbed moisture. A variety of experimental techniques were utilized to accomplish these studies: constant strain rate and dynamic tensile measurements, infrared spectroscopy, heat distortion tests, bomb creep tests, scanning electron microscopy, polarized-light photomicroscopy, and ESCA. The results established that moisture plasticized this particular epoxy resin, causing a lowering of the Tg which in turn affected mechanical response, such as by shifting the relaxation moduli to shorter times. This phenomenon is described and quantified in terms of an existing free volume theory relationship. GRA

N77-29311# Budd Co., Fort Washington, Pa. Technical Center.

A STUDY OF RIGID POLYURETHANE FOAM. VOLUME 1: SUMMARY Final Report, Jun. 1975 - Sep. 1976

V. A. Grasso Mar. 1977 24 p 2 Vol.
(Contract DOT-HS-5-01261)
(PB-266084/3; TCR-0334-Vol-1; DOT-HS-802-298) Avail: NTIS HC A02/MF A01 CSCL 11I

Short and long term applicability of light weight rigid polyurethane foam as applied to automobile structures for high speed crash energy management was studied. A definite conclusion was made to whether or not rigid polyurethane foam is feasible for use in automobile structures, and a preliminary set of performance specifications for future rule making action is presented. GRA

N77-29312# Budd Co., Fort Washington, Pa. Technical Center.

A STUDY OF RIGID POLYURETHANE FOAM, VOLUME 2 Final Report, Jun. 1975 - Sep. 1976

V. A. Grasso Mar. 1977 287 p refs 2 Vol.
(Contract DOT-HS-5-01261)
(PB-266085/0; TCR-0334-Vol-2; DOT-HS-802-299) Avail: NTIS HC A13/MF A01 CSCL 11I

The applicability of rigid polyurethane foams to automobile structures for high speed crash energy management is reported. Evaluated were attenuation characteristics, pertinent material properties, availability, fire hazards, product process, repairability and disposability. Impact tests were made on elements to assess the effects that various environments and conditions have on the energy absorbing characteristics of foam encased in a metallic structure. GRA

N77-29313# Lehigh Univ., Bethlehem, Pa. Center for Surface and Coatings Research.

WATER-BASE COATINGS Final Report, 17 Feb. - 15 Nov. 1975

Yung-Mien Chou, Leslie M. Confer, Ken Earhart, Mohammed S. El-Aasser, Joseph D. Hoffman, John A. Manson, Subodh Misra, Gary W. Poehlein, Joseph P. Scolere, and John W. Vanderhoff Wright-Patterson AFB, Ohio. AFML Aug. 1976 114 p refs
(Contract F33615-75-C-5213)
(AD-A040075; AFML-TR-74-208-Pt-2) Avail: NTIS HC A06/MF A01 CSCL 11/9

The purpose of this work was to develop water-based analogs of existing solvent-based epoxy primer and polyurethane topcoat systems. The approach was to prepare separate aqueous emulsions of epoxy resin and curing agent that could be mixed just before application and isocyanate prepolymer adducts that could be emulsified without reaction with water. Solvent-free, stable emulsions of epoxy resins with average particle diameter of 0.2 micro m and below were prepared using the anionic sodium lauryl sulfate-cetyl alcohol or the cationic hexadecyltrimethylammonium bromide-cetyl alcohol combinations as emulsifier. Also, cationic emulsions were prepared from the curing agent. The emulsification of these epoxy resins and curing agents was improved by the substitution of n-decane for the cetyl alcohol in the mixed emulsifier. In order to increase the curing rate of the epoxy films at room temperature, some chemical additives were incorporated either in the epoxy resin or the curing agent prepolymer prior to the emulsification process. The solvent-stripped cationic epoxy resin and curing agent emulsions were mixed in various proportions and cured at room temperature, or 55 C. A mechanism was established for the curing of emulsion-cast epoxy-curing agent films by determining the morphological properties and the dynamic mechanical properties of these films. The results demonstrated that the diffusion of the curing agent molecules into the epoxy resin particles is controlled by the

degree of interfacial crosslinking which takes place between the coalesced epoxy resin and curing agent particles. GRA

N77-29314# Alabama Univ., University. Dept. of Chemistry.
THE PREPARATION, POLYMERIZATION AND COPOLYMERIZATION OF SUBSTITUTED DERIVATIVES OF CYNICHRODENE (ETA5-C5H5)Cr(CO)2NO Interim Report
Charles U. Pittmann, Jr., Thane D. Rounsefell, John E. Sheats, Bruce H. Edwards, Marvin D. Rausch, and Eric A. Mintz 25 May 1977 14 p refs
(Contract N00014-75-C-0689)
(AD-A040817; Rept-17) Avail: NTIS HC A02/MF A01 CSCL 07/3

Reactivity ratios were obtained in radical initiated copolymerizations with styrene and N-vinyl-2- pyrrollaone. When M sub 2 was styrene, r sub (2) = 0.30 and r6 = 0.82. The value of the Alfrey-Price parameter e for vinylcynichrodene was -1.98 and the resonance interaction parameter Q was 3.1. Copolymerizations with N-vinyl-2-pyrrolidone (M sub 2) gave r sub 1 = 5.3, r sub 2 = 0.079 and e = -2.07. Thus, vinylcynichrodene is an exceptionally electron-rich vinyl monomer resembling vinylferrocene and vinylcymantrene. Vinylcynichrodene readily copolymerized with vinylcymantrene. GRA

N77-29315# Stanford Univ., Calif. Dept. of Applied Mechanics.
LINEAR THERMOMECHANICAL COUPLING EFFECT IN TRANSIENT DEFORMATION
Richard W. Young Aug. 1976 42 p refs
(Contract N00014-75-C-0698)
(AD-A036432; SU-DAM-75-10) Avail: NTIS HC A03/MF A01 CSCL 11/6

The interaction between the quasi-static mechanical deformation and the thermal state of solids is studied. Principles of classical thermodynamics are used to calculate temperature changes arising from the isentropic deformation of elastic solids. The theory of irreversible thermodynamics is used to predict temperature changes due to the adiabatic deformation of viscoelastic solids. It is found that such temperature changes are small and that the effect of thermomechanical coupling may usually be neglected in the non-oscillatory deformation of linear elastic, finite (rubber) elastic, and linear viscoelastic solids. Data are presented for several metals, rubbers, and plastics. Dynamic processes are not considered. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N77-29316*# Aerojet Liquid Rocket Co., Sacramento, Calif.
HIGH PERFORMANCE N2O4/AMINE ELEMENTS: BLOW-APART Interim Report
B. R. Lawver 18 May 1977 255 p refs
(Contract NAS9-14186)
(NASA-CR-151456; Rept-14186-3.1.1.) Avail: NTIS HC A12/MF A01 CSCL 21D

The mechanisms controlling hypergolic propellant reactive stream separation (RRS) were studied and used to develop design criteria for injectors free from both steady state RSS and cyclic propellant stream separation. This was accomplished through the analysis of single element injectors using N2O4/MMH propellants; the injectors were representative of the space shuttle orbit maneuvering engine and space tug applications. A gas phase/surface reaction mechanism which controls RSS was identified. Injector design criteria were developed, which defined a critical chamber pressure for those operating conditions above which RSS occurs. It was found that the amount of interfacial surface area at impingement is controlled by injector hydraulics. J.H.

N77-29317# Southwest Research Inst., San Antonio, Tex. US Army Fuels and Lubricants Research Lab.
RHEOLOGY STUDY OF ANTIMIST FUELS Final Report, Jul. 1975 - Dec. 1976
R. J. Mannheimer Jan. 1977 51 p refs
(Contract DOT-IA75WAI-571)
(AD-A030758/8; FAA-RD-77-10) Avail: NTIS HC A04/MF A01 CSCL 21/4

Two rheological phenomena have been studied that may relate to the mechanisms by which high molecular weight polymers inhibit misting. The first of these is a shear thickening or antithixotripic phenomenon in which the liquid fuel develops a shear induced structure above a critical shear stress. The second phenomenon involves the sudden increase in resistance to flow in porous media that certain polymer solutions exhibit when the flow rate is above a critical value. This effect is quite different from the first in that the former can be induced by shear while the latter requires elongation. The theoretical significance of the critical flow rate in porous media has been discussed in terms of a fluid relaxation time which in turn may be related to the polymer molecular weight. A relationship between the critical flow rate and the intrinsic viscosity is presented that explains why the former is more sensitive to polymer degradation. Author

N77-29318# Midwest Research Inst., Kansas City, Mo.
SYSTEM STUDY OF FUELS FROM GRAINS AND GRASSES Quarterly Progress Report, Jul. - Oct. 1976
W. Benson, R. Athey, and A. McElroy 15 Nov. 1976 70 p
(Contract E(29-2)-3729)
(DSE/3729-1) Avail: NTIS HC A03/MF A01

The current and potential U.S.A. production capability for grain and grass crops was determined. A preliminary screening of conversion processes was performed, and as well as preliminary technical and economic feasibility analyses. The results obtained to date on biomass production, conversion processes, and data management are reported. Author (ERA)

N77-29319# Institut Franco-Allemand de Recherches, St. Louis (France).
SENSITIVITY OF SEVERAL EXPLOSIVES TO A SHOCK WAVE CHARACTERIZED BY DURATION AND PRESSURE [SENSIBILITE DE DIVERS EXPLOSIFS A UNE ONDE DE CHOC CARACTERISEE EN DUREE ET PRESSION]
Y. DeLongueville, C. Fauquignon, and M. Moulard 16 Aug. 1976 27 p refs In FRENCH
(Contract SNPE-15/75/D.1182/B)
(ISL-CO-206/76J) Avail: NTIS HC A03/MF A01

An experiment was set up to submit a solid or liquid explosive sample to a shock wave of well-defined pressure and duration. The sensitivity was represented by an intrinsic curve in the pressure-duration plane. The value of the mechanical energy effectively transmitted to the explosive was associated with each point on the curve. An interpretation of the critical shock duration by the kinetic theory of chemical reactions was attempted. This led to the definition of an efficient chemical reaction initiation temperature for heterogeneous explosives. ESA

N77-29320# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
ASSESSMENT OF THE ROLE OF THE LIQUEFIED PETROLEUM GAS (LPG) ENGINE IN STAGE CARRIAGE SERVICE VEHICLES
G. G. Lucas Jul. 1976 37 p refs
(TT-7605) Avail: NTIS HC A03/MF A01

An assessment has been made into the viability of replacing the usual diesel engine in a public service vehicle with a spark ignition engine designed to operate on liquefied petroleum gas (LPG). The advantages of the LPG engine are less smoke, less noise, less odor, greater power for acceleration and less initial cost. The disadvantages are an increased fuel consumption in terms of miles per gallon and slightly higher emissions of carbon monoxide and unburnt hydrocarbons. The former may be alleviated however if the cost of LPG to the consumer is proportionately less than that of diesel fuel. In this the excise duty and rebate system is very important. The availability of LPG is good at present and is expected to increase over the next ten years. Author (ESA)

N77-29321# Stanford Research Inst., Menlo Park, Calif.
DENSITY ESTIMATION FOR NEW SOLID AND LIQUID EXPLOSIVES Final Report, 17 May 1976 - 16 Feb. 1977

Craig M. Tarver, Clifford L. Coon, and John M. Guimont 17 Feb. 1977 68 p refs
(Contract N60921-76-C-0146; SRI Proj. PYU-5425)
(AD-A038094) Avail: NTIS HC A04/MF A01 CSCL 19/1

The group additivity approach was shown to be applicable to density estimation. The densities of approximately 180 explosives and related compounds of very diverse compositions were estimated, and almost all the estimates were quite reasonable. Of the 168 compounds for which direct comparisons could be made (see Table 6), 36.9% of the estimated densities were within 1% of the measured densities, 33.3% were within 1-2%, 11.9% were within 2-3%, 8.9% were within 3-4%, and 9.0% were more than 4% different from the measured densities. Thus, of the densities estimated in this study, 82% were within 3% of the measured density. The average absolute error in density was approximately 0.022 g/cm3, and the absolute error in density exceeded 0.04 g/cm3 for only 24 of the 168 compounds (14.3%). The largest errors occurred for compounds with several bulky, highly polar groups in close proximity, and for compounds containing groups whose calculated molar volumes were based on density data for only two or three compounds. As more density data for a certain group configuration become available, the molar volume can be determined more accurately, and the overall agreement between measured and estimated densities of compounds containing that group should improve. GRA

N77-29322# Exxon Research and Engineering Co., Linden, N.J. Government Research Lab.
DEVELOPMENT OF HIGH STABILITY FUEL, PHASE 3 Final Report, 1 Jan. - 30 Nov. 1976
William F. Taylor and John W Frankenfeld Dec. 1976 91 p refs
(Contract N00140-74-C-0618)
(AD-A038977; EXXON/GRU.17.GAHF.76) Avail: NTIS HC A05/MF A01 CSCL 21/4

An extended program has been completed which meets the original objective of developing a High Stability JP-5 fuel. This fuel exhibits the markedly improved thermal stability characteristics required for high speed aircraft and yet retains the general physical characteristics of present day JP-5. This development makes possible the design of an improved performance Mach 4-5 speed range aircraft without resorting to cryogenic or specialty fuels and simplifies logistic problems because of its ability to be used in lower speed aircraft. Phase III of this contract was devoted to a study of the effects of selected jet fuel additives and of certain dissolved metals on the thermal stability of deoxygenated JP-5. In addition, a room temperature interaction between a pyrrole and a carboxylic acid, previously found to be deleterious to storage stability, was studied in more detail. The results of fuel stability research over the length of the contract are sumarized in this report and the implications of these results for establishing new fuel specifications are discussed. The potential effects of various refinery processes on fuel stability are reviewed. Recommendations concerning storage and handling techniques are also summarized. Author (GRA)

N77-29323# Federal Power Commission, Washington, D. C.
NATIONAL GAS SURVEY. REPORT TO THE FEDERAL POWER COMMISSION BY THE SUPPLY-TECHNICAL ADVISORY TASK FORCE ON THE REGULATORY ASPECTS OF SUBSTITUTE GAS
Dec. 1976 344 p refs 2 Vol.
(PB-265877/1) Avail: NTIS HC A15/MF A01 CSCL 21D

Regulations and legislation pertaining to gas production primarily from coal gasification production primarily from coal gasification plants in the U.S. and Canada are discussed. Topic areas cover water and air pollution, safety, and land use considerations. GRA

N77-29324# Federal Power Commission, Washington, D. C.
NATIONAL GAS SURVEY. REPORT TO THE FEDERAL POWER COMMISSION BY THE SUPPLY-TECHNICAL ADVISORY COMMITTEE STUDY SUBGROUP ON RESERVES AND RESOURCES CLASSIFICATIONS
Dec. 1976 162 p refs 2 Vol.
(PB-265878/9) Avail: NTIS HC A08/MF A01 CSCL 21D

Definitions and classifications pertaining to reserve resource terms are discussed along with a survey of natural gas resources. GRA

N77-29325# ICF, Inc., Washington, D.C.
PROJECT INDEPENDENCE EVALUATION SYSTEM (PIES) DOCUMENTATION. VOLUME 9: ALLOCATION OF EXPLORATORY ACTIVITY TO OIL AND NATURAL GAS IN THE FEA OIL AND GAS SUPPLY MODEL
Sep. 1976 70 p refs
(Contract FEA-CO-05-50301-00)
(PB-265772/4; FEA/N-76/419-Vol-9) Avail: NTIS HC A04/MF A01 CSCL 10A

The methodology used to associate the finding of oil or gas with specific exploratory drilling activity is described. Numerous price specific drilling profiles are included. Each of these drilling profiles is constructed on the basis of the economics of the particular hydrocarbon and its relationship to the drilling effort. GRA

N77-29326# ICF, Inc., Washington, D.C.
PROJECT INDEPENDENCE EVALUATION SYSTEM (PIES) DOCUMENTATION. VOLUME 13: COAL AND ELECTRIC UTILITY CONVENTIONS FOR PIES
Sep. 1976 60 p
(Contract FEA-CO-03-60466-00)
(PB-265824/3; FEA/N-76/423-Vol-13) Avail: NTIS HC A04/MF A01 CSCL 10A

A detailed annotated listing of the assumptions made in PIES regarding coal supply and electric utility operation is provided. The data included price assumptions for coal mines of different types, and capacity figures by fuel and load type for electric utility plants. GRA

N77-29327# Federal Energy Administration, Washington, D. C.
PROJECT INDEPENDENCE EVALUATION SYSTEM (PIES) DOCUMENTATION. VOLUME 2: PIES ECONOMETRIC DEMAND MODEL
Sep. 1976 47 p
(PB-265822/7; FEA/N-76/412-Vol-2) Avail: NTIS HC A03/MF A01 CSCL 10A

The structure of the energy demand model of the Project Independence Evaluation System is described. The demand model consists of several econometric submodels which describe regional final demand for various refined petroleum products, natural gas, electricity, and coal. The overall organization of the demand model is examined, and both the econometric results and the simulation conventions are discussed. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N77-29328 Stanford Univ., Calif.
PART 1: VORTEX AND EQUILIBRIUM SURFACE PROFILES OF SUPERFLUID HELIUM FOUR. PART 2: TENSILE STRENGTH AND VISIBLE ULTRASONIC CAVITATION OF SUPERFLUID HELIUM-FOUR Ph.D. Thesis
Philip Leslie Marston 1976 192 p
Avail: Univ. Microfilms Order No. 77-7126

Fizeau optical interferometry was used to study the state of rotating helium isotopes. Profiles of the free surface of the liquid for equilibrium and metastable states were calculated and compared with observations. The liquid was contained in a 2.15 cm diameter rotatable cylinder. Profiles were measured by interfering light reflected from the liquid surface with that reflected from the substrate. Motion picture photographs of cavitation revealed new characteristics pertinent to the liquid's tensile strength and bubble dynamics. A cylindrical acoustic standing wave with a frequency of 50.58 kHz induced the cavitation at a temperature of 2.09 K. Analysis of light diffracted by the sound gave measurements of the acoustic pressure amplitude which was used both for selecting the best drive frequency and for obtaining the tensile strength. Dissert. Abstr.

N77-29329# Hamburg Univ. (West Germany). Inst. fuer Schiffbau.
PROFILE FLOWS TAKING CAVITATION BUBBLE DYNAMICS INTO ACCOUNT [PROFILSTROEMUNGEN UNTER BERUECKSICHTIGUNG DER DYNAMIK VON KAVITATIONSBLASEN]
W. H. Isay, L. Lederer, and R. Voss Bonn DOKZENTBw 1976 48 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(BMVg-FBWT-76-22) Avail: NTIS HC A03/MF A01; DOKZENTBw, Bonn DM 30

The plane steady flow of gas-containing water around hydrofoil profiles was examined taking into account dynamic distortion and stability of bubbles and nuclei. The local gas volume ratio, the expansion of the bubble nuclei, and the pressure distribution were calculated for several profiles at given bubble size distribution. The applicability of the results to cavitation prediction of propellers was tested. The sound radiation of bubble systems in the pressure field of a profile was determined. ESA

N77-29330# Istituto Elettrotecnico Nazionale (Galileo Ferraris), Turin (Italy).
VACUUM EQUIPMENT FOR REALIZATION OF CESIUM VAPOR CELLS [CATENA DI VUOTO PER LA REALIZZAZIONE DI CELLE CON VAPORI DI CESIO]
Giovanni Moro and Giuseppe Rovera Dec. 1975 29 p refs In ITALIAN
(IENGF-RT-257) Avail: NTIS HC A03/MF A01

Vacuum equipment developed for filling cells with cesium vapor and buffer gas and capable of providing a high vacuum with good cleanliness characteristics is described. The technology for producing metallic cesium is illustrated, as are cell treatment and filling. The cells and lamps produced with this equipment have allowed the execution of research on the characteristics of a frequency standard based on optically pumped cesium vapor. ESA

N77-29331# Naval Ship Research and Development Center, Bethesda, Md. Ship Performance Dept.
MOTIONS AND DRAG OF AN AIR CUSHION VEHICLE WITH A DEEP SKIRT IN CALM WATER AND RANDOM WAVES
Alvin Gersten Jan. 1977 79 p refs
(50407056)
(AD-A039086; SPD-748-01) Avail: NTIS MF A01 CSCL 13/10

A model of an air cushion vehicle (ACV) with a deep pericell-type skirt and high cushion loading has undergone experiments in calm water and head random waves. The main goal of the investigation was to obtain drag and motion data which can be used to guide the design of a prototype. The results will also be used to validate computer predictions. Plots of mean drag are presented in this report, as are tables containing standard deviation values of motions and accelerations. The effect of model weight and volume air flow on drag and motions is discussed. It is also shown that this heavily loaded ACV has higher hump and post-hump drag than a similiarly configured ACV with smaller payload and shorter skirt. In addition, the heavier, deep-skirted vehicle pitches less and heaves about the same as the other craft. Author (GRA)

N77-29332# Naval Ship Research and Development Center, Bethesda, Md. Ship Performance Dept.
HYDRODYNAMIC PERFORMANCE OF THE MODEL OF A VARIABLE AREA WATERJET INLET DESIGNED FOR A 200 TON, 100 KNOT HYDROFOIL SHIP
Alan D. Sobolewski Feb. 1977 93 p refs
(AD-A038590; SPD-735-01) Avail: NTIS HC A05/MF A01 CSCL 13/7

The primary objective of this study was to assess the state-of-the-art in waterjet inlet design capability for high-speed hydrofoil applications. A contract was let for the design of a variable-area, strut-pod inlet for the waterjet propulsion system of a 200 ton, 100 knots hydrofoil ship. A basic requirement of the design was that the inlet must provide cavitation-free operation for prescribed flow-rates at both the 100 knots cruise and 35 knots take-off speed. The most up-to-date design procedures and performance prediction techniques were to be used. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N77-29333 Kansas Univ., Lawrence.
ACTIVE MICROWAVE MEASUREMENT OF SEA-SURFACE WINDS FROM SPACE Ph.D. Thesis
James Douglas Young 1976 422 p
Avail: Univ. Microfilms Order No. 77-2296

Backscatter measurements by the S-193 radiometer scatterometer aboard Skylab and associated data were analyzed to evaluate the accuracy of winds estimated from backscatter measurements. The results show that scattering at off nadir angles of 30 deg to 50 deg can be used for surface wind anemometry from about 4 m/sec up to the highest wind speeds observed, about 30 m/sec. The spatial frequency content of these measurements was also analyzed. The S-193 measurements studied were from a tropical hurricane, a tropical storm, and many extratropical wind systems. For most S-193 observations, an estimate of the local surface winds (ground truth) was determined using conventional measurements and estimation procedures used by meteorologists. Dissert. Abstr.

N77-29334 California Univ., San Diego.
INSTABILITY IN NONLINEAR SOLIDARY WAVE SYSTEMS Ph.D. Thesis
Charles Fredrick Driscoll 1976 104 p
Avail: Univ. Microfilms Order No. 77-8719

The stability of nonlinear waves is considered for one-dimensional anharmonic lattices, and for the generalized Korteweg-de Vries equations which model the lattice dynamics. Persistent nonlinear solitary propagating waves, or solitons, dominate the dynamics of these systems; these solitons give rise to the recurrence of initial states. It is shown that these nonlinear waves may in general show exponential instabilities. Dissert. Abstr.

N77-29335 Illinois Univ., Chicago.
RELATIVISTIC ELECTROMAGNETIC SCATTERING BY ACCELERATING OBSTACLES Ph.D. Thesis
George C. Douros 1976 117 p
Avail: Univ. Microfilms Order No. 77-6386

The problem of scattering of electromagnetic waves propagating in free space (sigma) by accelerating obstacles is formulated within the context of the general theory of relativity. Covariant Maxwell-Einstein electromagnetic field equations in the accelerating system (sigma prime) are derived such that the equations incorporate the coordinate transformations from sigma to sigma prime explicitly. These 4-tensor equations are expressed in three-dimensional vector form in sigma prime in order to exhibit their physical content and to facilitate solutions of the boundary value problems. The analogs of Maxwell's constitutive relations involve coordinate dependent factors which can be interpreted as equivalent electromagnetic parameters for an inhomogeneous material medium. Dissert. Abstr.

N77-29336 Utah Univ., Salt Lake City.
AN AUTOMATED, MICRO-DENSITOMETER, CARDIAC OUTPUT MEASUREMENT SYSTEM Ph.D. Thesis
Edward Lawrence Bond 1976 280 p
Avail: Univ. Microfilms Order No. 77-8445

The system features: (1) a small blood withdrawal rate (2 ml/min) and withdrawal volume (3 ml), (2) utilization of a small (1 mm OD) withdrawal catheter which is routinely used for central arterial pressure monitoring, (3) automated pumping sequences for withdrawal, infusion, calibration, and saline purging; and (4) disposable blood contacting elements. Each of the major non-specific components (oxygen saturation, hematocrit, cuvette flow, and red cell configuration), capable of producing optical artifacts in dye densitometry, has also been studied and the cause and effect of each presented. These studies, in addition to a review of densitometery methods, provided the necessary design requirements for development of a dichromatic microdensitometer. Experimental studies were conducted to quantitate the

effect of these components on calibrating and using the densitometer. Dissert. Abstr.

N77-29337 California Univ., Los Angeles.
SOURCE CODING AND ADAPTIVE DATA COMPRESSION FOR COMMUNICATION NETWORKS Ph.D. Thesis
Howard Steven Nussbaum 1976 220 p
Avail: Univ. Microfilms Order No. 77-7677

Coding under a fidelity criteria of a class of sources which emit randomly occurring messages is investigated. For this class of sources the rate distortion function is derived, and source coding and converse source coding theorems are proven. Employing these theorems, an operational definition of the rate distortion function in terms of message queueing delay, and transmission delay is presented. This definition relates the rate distortion function with the message network delay which is an important measure of performance of a communication network. An adaptive data compression scheme which utilizes observations of the network congestion to determine the amount of compression a message receives, with the object of minimizing the message delay for a given distortion level is investigated. Dissert. Abstr.

N77-29338 Florida Univ., Gainesville.
MODULATION AND DEMODULATION OF RF SIGNALS BY BASEBAND PROCESSING Ph.D. Thesis
Jorge A. Cruz-Emeric 1976 197 p
Avail: Univ. Microfilms Order No. 77-8160

A technique for modulating a carrier by a variety of modulation laws is analyzed. The technique is based on the separate generation of the complex envelope function by a baseband preprocessor. The complex envelope is then used to modulate the carrier. Since the complex envelope function depends exclusively on the modulation law and on the message signal, the baseband preprocessor can be programmed to obtain the desired modulation law. Direct generation of complex valued signals is not physically possible so various alternatives which exist to realize the modulation process are discussed. Dissert. Abstr.

N77-29339 Illinois Univ., Urbana-Champaign.
IONOSPHERIC MODELING FOR HF RADIO SOURCE LOCATION FROM A SINGLE SITE Ph.D. Thesis
Keith Eugene Hoover 1976 283 p
Avail: Univ. Microfilms Order No. 77-9034

Short range radio source location from a single RDF site is discussed. It is found that, for the purpose of single-site location, the ionosphere can be modeled as a reflecting surface to varying degrees of accuracy and detail. Several on-site methods of determining the parameters of these various models are demonstrated using both experimental and simulated data. Experimental results of radio source location performed using untilted, tilted, and moving irregularity models are presented. It is found that the moving model can offer noticeable decreases in the average source location error over short (30 km) ranges. However, it is found that the simplest untilted model may offer superior results over longer ranges. Dissert. Abstr.

N77-29340 Johns Hopkins Univ., Baltimore, Md.
SELECTING CODES FOR COMMUNICATION CHANNELS Ph.D. Thesis
Clive Eric Holborow 1977 216 p
Avail: Univ. Microfilms Order No. 77-7735

Problems encountered in selecting a block code for the high speed additive Gaussian noise channel are discussed. A good code for this channel is one which requires low signal-to-noise ratio per information bit to achieve a specified post-decoding word error probability. The signal to noise ratio required to achieve several word error rates using binary BCH codes and Reed-Solomon codes of various lengths was calculated. The cost of implementing binary BCH codes was compared with that of implementing Reed-Solomon codes by the normal method and by a transform method recently suggested by Gore. For high (megabit) data rates, binary BCH codes give the best performance for a given level of equipment complexity. The amount of additional hardware necessary to implement weighted erasure decoding is also determined. Dissert. Abstr.

N77-29341 City Univ. of New York.
ARITHMETIC PROCESSING AND DIGITAL CONVERSION OF ADAPTIVE DELTA MODULATION ENCODED SIGNALS Ph.D. Thesis
Joseph Lawrence LoCicero 1977 220 p
Avail: Univ. Microfilms Order No. 77-7355

Direct arithmetic processing of adaptive delta modulation encoded signals is studied. Conversion from adaptive delta modulation encoded signals to pulse code modulation encoded signals also was presented. Operating on the delta modulation bit stream, and employing only standard digital hardware, the sum, difference and product is obtained in regard to these formats. Dissert. Abstr.

N77-29342 Illinois Univ., Urbana-Champaign.
MODELS AND EFFICIENT RECEIVERS FOR COMMUNICATION CHANNELS WITH MEMORY Ph.D. Thesis
Pramod Kumar Varshney 1976 137 p
Avail: Univ. Microfilms Order No. 77-9225

The idea of receivers with memory was investigated and a suboptimal receiver with one bit memory was derived which performed better than the optimal receiver without memory. A receiver with large memory consisting of an estimator and a detector was developed. The decision rule adapts to the channel conditions based on the information provided by the estimator. The performance of the receiver was examined by computing the average probability of error. The estimator is a limited-memory decision-feedback estimator, the estimation criterion being the MMSE. A methodology is described which can be used to develop channel models based on the physical processes involved. Two measures are defined which quantitatively characterize the correlation of errors and then, the relationship of the receiver design problem to channel modeling is examined. Dissert. Abstr.

N77-29343 Columbia Univ., New York.
EXACT ANALYSIS OF WAVEGUIDE JUNCTIONS BY RANK-REDUCTION Ph.D. Thesis
Douglas Norman Zuckerman 1976 109 p
Avail: Univ. Microfilms Order No. 77-8879

The low rank spectral expansion technique is discussed and used to solve the problem of scattering at a waveguide discontinuity. By a low rank spectral decomposition of the matrix representing asymptotically ill-conditioned portions of the linear equation for the current expansion coefficients, it is possible to solve for the currents without inverting a large ill-conditioned matrix. The method is used to solve the problem of scattering at a slant interface in a rectangular waveguide. Numerical results are also given for a rectangular waveguide hybrid junction in the dominant mode regime. Dissert. Abstr.

N77-29344 Illinois Univ., Urbana-Champaign.
A METHOD FOR COMBINING INTEGRAL EQUATION AND ASYMPTOTIC TECHNIQUES FOR SOLVING ELECTROMAGNETIC SCATTERING PROBLEMS Ph.D. Thesis
Wai Lee Ko 1976 215 p
Avail: Univ. Microfilms Order No. 77-9056

The geometrical theory of diffraction takes advantage of the fact that the Fourier transform of the unknown surface current distribution is proportional to the scattered far field. A number of asymptotic methods are available that provide good approximation to this far field in a convenient analytic form which is useful for deriving an initial estimate of the Fourier transform of the current distribution. An iterative scheme is developed for systematically improving the initial form of the high frequency asymptotic solution by manipulating the integral equation in the Fourier transform domain. A synthetic-aperture-distribution scheme is also developed in which the approximate scattered far-field pattern obtained by asymptotic techniques is improved by systematically correcting the scattered field distribution on an aperture erected in juxtaposition with the obstacle.
Dissert. Abstr.

N77-29345 Illinois Univ., Urbana-Champaign.
OPTICAL WAVE PROPAGATION IN INHOMOGENEOUS TURBULENCE
Peter Chi-Chung Lam 1976 104 p
Avail: Univ. Microfilms Order No. 77-9063

The parabolic equation method is used to study optical wave propagation in inhomogeneous turbulence. Differential equations for the average field and second order mutual coherence functions

are derived. The equations are similar in form to those obtained for homogeneous turbulence but are considerably more difficult to solve. Approximate solutions are obtained using the method of smooth perturbations and their region of validity is determined. Dissert. Abstr.

N77-29346# Office of Telecommunications, Boulder, Colo. Inst. for Telecommunication Sciences.
ANTENNA TILTING EXPERIMENTS OVER RADAR MICROWAVE LINKS Final Report
W. J. Hartman Feb. 1977 29 p refs
(Contract DOT-FA74WAI-419)
(AD-A036727; FAA-RD-77-5) Avail: NTIS HC A03/MF A01 CSCL 01/2

Signal level recordings were made simultaneously for two systems. One utilized an antenna tilted upward to obtain a 2 db loss over optimum alignment and the other used an untilted antenna. The path was a 42.3 km radar microwave link over relatively flat terrain covered with tall trees. The results showed essentially identical fading on both systems. Author

N77-29347# Electromagnetic Compatibility Analysis Center, Annapolis, Md.
A MODEL TO PREDICT MUTUAL INTERFERENCE EFFECTS ON AN AIRFRAME Final Report
Priscilla A. Dwyer (IIT Research Inst., Annapolis, Md.) Oct. 1976 157 p refs
(Contract DOT-FA70WAI-175)
(AD-A039224/1; ECAC-PR-76-067; FAA-RD-76-50) Avail: NTIS HC A08/MF A01 CSCL 09/3

An analysis model has been developed to determine the mutual interference effects of introducing new avionics equipment to an existing airframe, containing operational equipment. The model has been updated, improved, and expanded in a series of scheduled efforts. Those improvements are summarized and the current version of the model is completely documented. Author

N77-29348# Lincoln Lab., Mass. Inst. of Tech., Lexington.
COMPARISON OF THE PERFORMANCE OF THE MOVING TARGET DETECTOR AND THE RADAR VIDEO DIGITIZER
R. M. Odonnell and L. Cartledge Hanscom AFB, Mass. 26 Apr. 1977 90 p refs
(Contract F19628-76-C-0002)
(AD-A040472; ATC-70; FAA-RD-76-191) Avail: NTIS HC A05/MF A01 CSCL 17/9

Side by side simultaneous tests were made to compare the performance of the moving target detector (MTD) digital signal processor and that of an adaptive sliding window detector, the radar video digitizer (RVD-4). The MTD, used with a highly modified FPS-18, employs coherent linear doppler filtering, adaptive thresholding, and a fine grained clutter map which together reject all forms of clutter simultaneously. The RVD-4, which was used with an ASR-7, is a nonlinear, noncoherent digital processor. The detection and false alarm performance of both processors in thermal noise was identical. Measured detection and sub-clutter visibility performance of the MTD on controlled aircraft flying in heavy rain, in heavy ground clutter, and at near zero radial velocity is shown to be superior to that of the RVD-4. MTD report data is also shown to be more accurate than the RVD-4 data resulting in improved ARTS-3 tracker performance when using MTD processed data. Author

N77-29349*# McDonnell-Douglas Astronautics Co., Houston, Tex.
ORBITER CCTV VIDEO SIGNAL NOISE ANALYSIS
R. M. Lawton, L. R. Blanke, and R. F. Pannett 5 Aug. 1977 11 p refs
(Contract NAS9-14960)
(NASA-CR-151479; Rept-1.3-DN-C0704-039) Avail: NTIS HC A02/MF A01 CSCL 17B

The amount of steady state and transient noise which will couple to orbiter CCTV video signal wiring is predicted. The primary emphasis is on the interim system, however, some predictions are made concerning the operational system wiring in the cabin area. Noise sources considered are RF fields from on board transmitters, precipitation static, induced lightning currents, and induced noise from adjacent wiring. The most significant source is noise coupled to video circuits from associated circuits in common connectors. Video signal crosstalk is the primary cause of steady state interference, and mechanically switched control functions cause the largest induced transients. Author

N77-29350*# Gold (Robert) Associates, Los Angeles, Calif.
TDRSS TELECOMMUNICATIONS SYSTEM, PN CODE ANALYSIS Final Report
Robert Dixon, Robert Gold, and Fred Kaiser 31 Aug. 1976 442 p refs
(Contract NAS5-22546)
(NASA-CR-152579) Avail: NTIS HC A19/MF A01 CSCL 17B

The pseudo noise (PN) codes required to support the TDRSS telecommunications services are analyzed and the impact of alternate coding techniques on the user transponder equipment, the TDRSS equipment, and all factors that contribute to the acquisition and performance of these telecommunication services is assessed. Possible alternatives to the currently proposed hybrid FH/direct sequence acquisition procedures are considered and compared relative to acquisition time, implementation complexity, operational reliability, and cost. The hybrid FH/direct sequence technique is analyzed and rejected in favor of a recommended approach which minimizes acquisition time and user transponder complexity while maximizing probability of acquisition and overall link reliability. Author

N77-29351# Federal Aviation Administration, Washington, D.C.
SURVEILLANCE AND DATA LINK ENHANCEMENT PROGRAM Final Report
E. J. Koenke and J. M. Garot Jan. 1977 38 p ref
(AD-A041299; FAA-EM-77-7) Avail: NTIS HC A03/MF A01 CSCL 17/2

Background and rationale are explained regarding an agreement between the U.S. Federal Aviation Administration and French Civil Aviation; results of a plenary meeting are given. The purpose of the agreement is to develop parameters for a common future air traffic control system. This includes communications, surveillance, approach and guidance technology, and navigation. Author

N77-29352# ACLS Corp., Chevy Chase, Md.
SUPPORT CONTRACTOR TASKS FOR APPLYING THE INTEGRATED NATIONAL AIRSPACE COMMUNICATIONS SYSTEM (INACS) CONCEPT TO FAA TELECOMMUNICATIONS SYSTEM Final Report
John L. Loeb and Frederick R. Fearnow Apr. 1977 14 p refs
(AD-A041138; FAA-RD-77-63) Avail: NTIS HC A02/MF A01 CSCL 17/2

General comments about the integrated national airspace communication system concept are reported. Guidelines for a support contract and contractor evaluation, and tasks to be included in a statement of work for a support contractor are also presented. Author

N77-29353*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
USERS' MANUAL FOR COMPUTER PROGRAM FOR ONE-DIMENSIONAL ANALYSIS OF COUPLED-CAVITY TRAVELING WAVE TUBES
Thomas A. Omalley and Denis J. Connolly Washington Aug. 1977 67 p refs
(NASA-TM-X-3565; E-8900) Avail: NTIS HC A04/MF A01 CSCL 09C

The use of the coupled cavity traveling wave tube for space communications has led to an increased interest in improving the efficiency of the basic interaction process in these devices through velocity resynchronization and other methods. To analyze these methods, a flexible, large signal computer program for use on the IBM 360/67 time-sharing system has been developed. The present report is a users' manual for this program. Author

N77-29354# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
THE BEVERAGE WAVE ANTENNA: RADIATION FIELD PATTERNS
Robert M. Sorbello Feb. 1977 76 p refs

(Contracts F19628-76-C-0057; N00014-75-C-0648; AF Proj. 5635)
(AD-A040051; Scientific-2; RADC-TR-77-83) Avail: NTIS HC A05/MF A01 CSCL 20/14

This report presents the results of a theoretical and experimental investigation of the transmitting and receiving properties (far-field radiation patterns) of horizontal-wire antennas placed over an imperfectly conducting halfspace. Particular emphasis is given to the Beverage Wave Antenna, a special type of horizontal-wire antenna placed in close proximity to the earth. Early work by Sommerfeld showed that the radiation from a dipole above an imperfect earth could be separated into a space wave (which could reflect off the ionosphere and which predominates at large distances above the earth) and a surface wave (which could diffract around the curvature of the earth and which dominates close to the surface). Because of the difficulties involved in solving the Sommerfeld integral formulation, asymptotic approximations valid in the radiation zone have generally been employed to solve this problem. The useful approximate forms developed earlier by Norton have been used in this study, the only difference being that in the present analysis the exact expressions for the antenna current are used rather than an assumed current distribution. An expression for the space-wave radiation pattern is formulated using a 'geometric optics' approximation, while the superposition principle is used to sum the fields of individual infinitesimal dipoles to obtain the surface-wave radiation pattern. Expressions for a number of useful antenna parameters (efficiency, front-to-back ratio, antenna gain, effective length) are then derived. GRA

N77-29355# New Mexico State Univ., University Park. Physical Science Lab.
STRIPLINE ANTENNAS FOR A SMALL SPHERE Scientific Report, Feb. 1976 - Jan. 1977
Alexander Waterman and Dennis G. Henry Hanscom AFB, Mass. AFGL Feb. 1977 32 p ref
(Contract F19628-75-C-0072; AF Proj. 7659)
(AD-A040041; PS-00872; AFGL-TR-77-0064; SR-2) Avail: NTIS HC A03/MF A01 CSCL 09/5

The development of a stripline S-band telemetry array and a C-band beacon antenna is presented. Both units are mounted in a small area just under the surface of a 10.12 inch diameter sphere. Author (GRA)

N77-29356# California Univ., Livermore. Lawrence Livermore Lab.
COMPUTER ANALYSIS OF THE TRUSSED-WHIP AND DISCONE-CAGE ANTENNAS
F. J. Deadrick, G. J. Burke, and A. J. Poggio 6 Jan. 1977 20 p refs
(UCRL-52201) Avail: NTIS HC A02/MF A01

Two U.S. Navy communications antennas, the trussed-whip and the discone-cage, are numerically modeled and analyzed. Results are obtained for antenna input impedance in the HF frequency range and are compared directly with scale-model measurements. An improvement in the numerical results obtained for wire of varying radii is obtained by use of the numerical electromagnetics code (NEC) modeling program. ERA

N77-29357# Valvo G.m.b.H., Hamburg (West Germany).
TUNING DIODES FOR LOW dc VOLTAGES Final Report
Gerhard Raabe Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1976 67 p refs In GERMAN; ENGLISH summary
(Contract BMFT-NT-513)
(BMFT-FB-T-76-79) Avail: NTIS HC A04/MF A01; ZLDI, Munich DM 14.10

New technologies are described for producing hypersensitive doping profiles and to meet the required capacitance voltage variation of low voltage tuning diodes. The method of controlled gas phase profile doping during epitaxy allows dopant variations of 3000 fold over a distance of 3.6 micron. Mesa-planartechnique and boron diffusion are used for making the pn-junction. Diode triplets with a capacitance matching performance of less than about 1 to 3 % and a capacitance variation of more than 30 were produced. Doping profile tolerances of less than 5 %, epilayer thickness variations of less than 2 %, and variations in the depth of the pn-layer less than 0.01 micron are necessary to obtain this performance. Diodes, produced by these methods, have a good long life stability and show a satisfactorily signal handling capability. Author (ESA)

N77-29358# Centre National d'Etudes Spatiales, Toulouse (France).
STUDY OF A DIGITAL PHASE LOCKED LOOP IN VERY LOW FREQUENCIES [ETUDE ET REALISATION D'UNE BOUCLE DE PHASE NUMERIQUE TRES BASSE FREQUENCE]
Daniel Dassaud Dec. 1976 101 p refs In FRENCH; ENGLISH summary
(CNES-NT-62) Avail: NTIS HC A06/MF A01

The study and the implementation of a very low frequency digital phase locked loop in the specific application of the synchronization of image taking in the geostationary Meteosat satellite are described. Wiener's method was used to obtain the optimum filter and the implementation of this filter was achieved with the M 6800 microprocessor. The results are adaptable for any spinned satellite in which phases or frequencies slaved to the spin rate are desired. Author (ESA)

N77-29359# Centre National d'Etudes Spatiales, Toulouse (France).
EFFECTIVE NON IONOSPHERIC PROPAGATION OF ELECTROMAGNETIC WAVES AT THE EARTH SURFACE [PROPAGATION REELLE NON IONOSPHERIQUE DES ONDES ELECTROMAGNETIQUES A LA SURFACE DE LA TERRE]
Daniel Dassaud Dec. 1976 46 p refs In FRENCH; ENGLISH summary
(CNES-NT-63) Avail: NTIS HC A03/MF A01

An introduction to the real propagation of electromagnetic waves on the surface of the earth precluding ionospheric refraction is presented. The free space propagation is specially discussed together with the propagation in the reflection region, the ground wave propagation, and the propagation with tropospheric diffusion. Finally, problems linked to the obstacles on the propagation path and the ones concerning the variations of the characteristics of the earth's atmosphere are considered. Author (ESA)

N77-29360# Centre National d'Etudes Spatiales, Toulouse (France).
CHARACTERISATION BY MICROWAVE TECHNIQUES OF A SEMICONDUCTOR UNDER PHOTON IRRADIATION [CARACTERISATION PAR UNE TECHNIQUE MICRO-ONDE D'UN SEMI-CONDUCTEUR SOUMIS A UNE INJECTION PHOTONIQUE]
Paulette Dorio and Marc Orgeret Mar. 1977 58 p refs In FRENCH; ENGLISH summary
(CNES-NT-69) Avail: NTIS HC A04/MF A01

The new technique described permits the determination of excess carrier physical parameters in a semiconductor: diffusion length, diffusion constant, carrier lifetime, and surface recombination velocity. The method utilizes the modulation of a transmitted microwave signal through the sample by a variable frequency infrared excitation source on the sample. The parameters are determined by studying the phase difference of the modulated microwave signal and the infrared signal as a function of the modulation frequency of the infrared excitation. The measurement method and the method of physical parameters identification are detailed. With this method any physical contact or surface treatment of the sample under evaluation is avoided. Measurements were made on high resistivity silicon samples.
Author (ESA)

N77-29361# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
CLASSIFICATIONS OF RADAR TARGETS BY COHERENT MEASURED ECHO SIGNALS [UEBER EINE KLASSIFIZIERUNGSMOEGLICHKEIT VON RADARZIELEN MITTELS KOHAERENT GEMESSENER ECHOSIGNALE]
K. vonSchlachta Jan. 1977 94 p refs In GERMAN; ENGLISH summary
(FFM-250) Avail: NTIS HC A05/MF A01

Classification of radar targets can be performed using typical differences in signal fluctuation. This was found by coherent measurements with different surveillance radars. The decision rule for the classification is a Neyman-Pearson test.

The efficiency of suitable test functions was checked by numerical calculations and by the use of stored radar signals. Target models were developed which describe the fluctuation properties of aircraft. They were derived from evaluated radar data by comparison with standard probability functions and were used to calculate the optimal test functions. Examples of a binary fluctuation test show the efficiency of a classification of jet and propeller aircraft and the probability of correct classification of bird and jet echoes. Author (ESA)

N77-29362# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).

KALMAN FILTER FOR ASYNCHRONOUS TRIANGULATION OF FAST FLYING OBJECTS FROM N MOBILE RADAR STATIONS [KALMAN FILTER ZUR ASYNCHRONEN TRIANGULIERUNG SCHNELLER FLUGOBJEKTE AUS N BEWEGLICHEN RADARSTELLUNGEN]

G. vanKeuk Mar. 1977 80 p refs In GERMAN; ENGLISH summary

(FFM-251) Avail: NTIS HC A05/MF A01

A suboptimal Kalman filter working in an inertial coordinate system was developed to estimate the state of a maneuvering high speed target using angles only, measured from N radar stations at different times. The stations were not assumed to be fixed. Numerical examples of the accuracy of the estimated state are presented. The method is well suited for real time computer aided tracking application in multi radar systems. Author (ESA)

N77-29363# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).

COHERENT SEQUENTIAL TEST WITH CLUTTER SUPPRESSION [KOHAERENTER SEQUENTIALTEST MIT CLUTTERUNTERDRUECKUNG]

W. D. Wirth , Mar. 1977 10 p refs In GERMAN; ENGLISH summary

(FFM-253) Avail: NTIS HC A02/MF A01

A coherent sequential test for signals with unknown Doppler frequency is compared with the incoherent test in respect of the mean test length. The number of filters in the filter bank increases by receiving new echoes. The distance between filters should be less than half the distance usual for Fourier transform. All filters need a high attenuation at Doppler frequency zero for clutter suppression. The mean frequency transfer function is improved in comparison to a fixed sample size test, if equal mean test lengths in noise are adjusted. Author (ESA)

N77-29364# Marconi Communication Systems Ltd., Chelmsford (England). System Studies Group.

LO 4 TV BROADCAST AND TELECOMMUNICATIONS SYSTEM DEFINITION STUDY, VOLUME 1 Final Report

Mar. 1977 190 p refs 2 Vol.

(Contract ESTEC-2828/76-NL-SW)

(CWJ1/C-640012-Vol-1; ESA-CR(P)-924-Vol-1) Avail: NTIS HC A09/MF A01

A preliminary system definition study of the proposed 12-14 GHz television broadcasting and telecommunications mission for the Ariane LO4 platform is presented. The broadcasting mission analysis covers Norway, Greenland, and Iceland. It is shown that some degree of uplink power control is required to cover the Greenland/Iceland area. Increasing the range of ALC in the satellite allows greater tolerance of downlink fading. The use of FDMA and TDMA systems for the telecommunications mission is discussed. Recommendations are made for further study, in particular on the atmospheric attenuation model of the area to be covered. ESA

N77-29365# Marconi Communication Systems Ltd., Chelmsford (England). System Studies Group.

LO 4 TV BROADCAST AND TELECOMMUNICATION SYSTEM DEFINITION STUDY. VOLUME 2: WORK PACKAGES 3 AND 4 Supplement to Final Report

Mar. 1977 26 p 2 Vol.

(CWJ1/C-640012-Vol-2; ESA-CR(P)-924-Vol-2) Avail: NTIS HC A03/MF A01

Supplementary information is provided to the preliminary system definition study of the proposed 12-14 GHz television broadcasting and telecommunications mission for the Ariane LO4 platform. Items at variance with the original system requirements are indicated, and appropriate changes to specifications to rectify these incompatibilities are suggested. ESA

N77-29366# Hawker Siddeley Dynamics Ltd., Stevenage (England). Space Div.

LIDAR DEVELOPMENT COST STUDY REPORT. VOLUME 1: TECHNICAL

G. W. Cocks, A. F. Cole, and K. Hecks Aug. 1976 64 p

(Contract ESA-2705/76-NL)

(HSD-TP-7594; ESA-CR(P)-929) Avail: NTIS HC A04/MF A01

The results of a cost and program estimate for a Spacelab-borne lidar facility are presented. Various model philosophies were examined and a single flight model with identified spares backing was selected to meet program constraints and provide an optimum cost/risk ratio. A program is given which will meet the required launch date, identifying predicted problem areas. A budgetary cost estimate for the identified project is given, detailed down to unit level. Several areas where lack of requirements gives rise to cost uncertainty are described. Author (ESA)

N77-29367# Centre National de la Recherche Scientifique, Marseilles (France). Lab. d'Astronomie Spatiale.

THEORY AND COMPUTING METHODS FOR STACKED THIN FILMS [THEORIE ET METHODES DE CALCULS D'EMPILEMENTS DE COUCHES MINCES]

Michel Blanc 2 Dec. 1975 74 p In FRENCH

(LAS-75-OPT-25) Avail: NTIS HC A04/MF A01

A presentation is given of the mathematical formulation that enables to calculate, using the admittance method, the amplitudes and phases of transmitted absorbed and reflected electromagnetic radiation when normal or oblique incident radiation is in the presence of a stack of thin films with known thicknesses and optical constants. Computer programs derived from the formulae are given. ESA

N77-29368# Ohio State Univ., Columbus. ElectroScience Lab.

ADAPTIVE ARRAYS FOR AM AND FM SIGNALS Quarterly Report, 1 Dec. 1976 - 28 Feb. 1977

R. T. Compton, Jr. Mar. 1977 9 p refs

(Contract N00019-77-C-0156)

(AD-A038871; ESL-4618-1; QR-1) Avail: NTIS HC A02/MF A01 CSCL 17/2

This report describes progress under Naval Air Systems Command Contract N00019-77-C-0156 during the first quarterly period. Research on the problem of integrating adaptive arrays into conventional modulation systems is summarized. Author (GRA)

N77-29369# Army Materiel Development and Readiness Command, Alexandria, Va.

ENGINEERING DESIGN HANDBOOK. ELECTROMAGNETIC COMPATIBILITY

Mar. 1977 704 p refs

(AD-A038803; DARCOM-P-706-410) Avail: NTIS HC A99/MF A01 CSCL 20/14

The Engineering Design Handbook Series of the US Army Materiel Development and Readiness Command is a coordinated series containing basic information and fundamental data useful in the design and development of Army material and systems. The handbooks are authoritative reference books of practical information and quantitative facts helpful in the design and development of Army material. The purpose of this particular handbook is to take the wealth of information accumulated by the Army over a period of years on the subject of electromagnetic compatibility and make this information available to the designer. In support of the design information, the handbook contains discussion of electromagnetic field coupling mechanisms, nonlinear circuit effects, and statistical concepts necessary to an understanding of the phenomena involved. GRA

N77-29370# Naval Weapons Center, China Lake, Calif.

TRANSMISSION OF MONOCHROMATIC ELECTROMAGNETIC WAVES THROUGH SYSTEMS CONSISTING OF MULTIPLE LAYERS OF MATERIALS EXHIBITING BIREFRINGENCE OR FARADAY ROTATION

David J. White Mar. 1977 61 p refs
(AD-A038602; NWC-TP-5900) Avail: NTIS HC A04/MF A01 CSCL 20/14

The problem of plane electromagnetic wave propagation through systems consisting of plates or layers of birefringent or gyroelectric materials is considered. Scattering matrices for the two types of layers are given, where propagation is normal to the plates and along a natural axis or the Faraday direction. The equations for converting the 4 x 4 scattering matrices to 4 x 4 transmission matrices are given. The overall transmission matrix for a system is then found by multiplying the appropriate coordinate transformation matrices together with the transformation matrices of the individual layers. Various optical and microwave examples of isolators and phase shifters are worked out. GRA

N77-29371# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Electrical and Systems Engineering.
AN EMPIRICAL STUDY OF SELECTED APPROACHES TO THE DETECTION OF EDGES IN NOISY DIGITIZED IMAGES
R. W. Fries Mar. 1977 48 p refs
(Contract N00014-75-C-0281)
(AD-A039816; TR-77-1) Avail: NTIS HC A03/MF A01 CSCL 09/4

This paper is concerned with an empirical evaluation of the relative performance of several selected edge detectors for the detection of edge structure in noisy digitized images. In particular, we consider both the Hueckel operator and a recently introduced class of edge detectors implemented as two-dimensional infinite inpulse response (IIR) or recursive digital filters. The latter were originally developed on the basis of least mean-square Wiener spatial filtering concepts for an assumed stochastic model of edge structure in typical imagery data. These two schemes are compared with respect to performance, computational complexity and suitability for specific applications. Problems in making these comparisons are discussed. The implementations of both operators used for this comparison are described in detail. Author (GRA)

N77-29372# Office of Telecommunications, Annapolis, Md.
TECHNICAL CONSIDERATION OF SMALL FIXED, MOBILE, AND TRANSPORTABLE SATELLITE SYSTEMS Technical Report, 1976 - 1977
Harold J. Ng Mar. 1977 72 p refs
(PB-266660/0) Avail: NTIS HC A04/MF A01 CSCL 17B

The potential impact of current rules and regulations on the implementation of small earth terminals in the satellite services was investigated. This investigation shows that the current ITU, OTP, and FCC regulations do not adequately consider the technical and operational factors unique to the fixed, the mobile and the transportable earth terminals with small aperture antennas. The main areas in the current regulations and the technical characteristics associated with small earth terminals which might inhibit the introduction of such systems in the satellite services are identified. GRA

N77-29373# Network Analysis Corp., Glen Cove, N. Y.
INTEGRATED DOD VOICE AND DATA NETWORKS AND GROUND PACKET RADIO TECHNOLOGY. VOLUME 1: INTEGRATED DOD VOICE AND DATA NETWORKS, PART 1 Semiannual Technical Report
Howard Frank and Israel Gitman Mar. 1977 292 p refs
(Contract DAHC15-73-C-0135; ARPA Order 2286)
(AD-A039329; SATR-8) Avail: NTIS HC A13/MF A01 CSCL 17/2

New research results on the following major questions are reported. Results on integrated DOD voice and data networks include: (1) analytical models for determining blocking and delay on an integrated link, (2) numerical investigation as a function of traffic and design variables, and (3) algorithms for integrated network design. The program is capable of designing networks for voice traffic, signaling, and data traffic. A circuit switch model for determining switch and network transit delays for circuit connection setup was developed. A methodology for classification of telecommunications routing algorithms was also developed. Author (GRA)

N77-29374# Network Analysis Corp., Glen Cove, N. Y.
INTEGRATED DOD VOICE AND DATA NETWORKS AND GROUND PACKET RADIO TECHNOLOGY. VOLUME 1: INTEGRATED DOD VOICE AND DATA NETWORKS, PART 2 Semiannual Technical Report
Howard Frank and Israel Gitman Mar. 1977 261 p refs
(Contract DAHC15-73-C-0135; ARPA Order 2286)
(AD-A039330; SATR-8) Avail: NTIS HC A12/MF A01 CSCL 17/2

Contents: Network Models for Packetized Speech; and A Circuit Switch Node Model. GRA

N77-29375# Network Analysis Corp., Glen Cove, N. Y.
INTEGRATED DOD VOICE AND DATA NETWORKS AND GROUND PACKET RADIO TECHNOLOGY. VOLUME 4: GROUND PACKET RADIO TECHNOLOGY Semiannual Technical Report
Howard Frank and Israel Gitman Mar. 1977 101 p
(Contract DAHC15-73-C-0135; ARPA Order 2286)
(AD-A039333; SATR-8) Avail: NTIS HC A06/MF A01 CSCL 17/2

Repeaters in the radio network need to be initialized by the station; namely, to receive a so-called label which enables addressing specific devices during packet transportation. It is assumed that a priori the station is not informed of the existance and location of specific repeaters. Hence, the initialization process involves sending special control packets, called Repeater On Packets (ROP's) from repeaters to the station to inform existance and location, the transmission of labels by the station to repeaters identified, and the transmission of End-to-End Acknowledgments (ETE Ack's) by repeaters which receive a label. A repeater is considered by the station to be initialized after the station receives an ETE Ack to the label packet. GRA

N77-29376# Network Analysis Corp., Glen Cove, N. Y.
INTEGRATED DOD VOICE AND DATA NETWORKS AND GROUND PACKET RADIO TECHNOLOGY. VOLUME 2: COST TRENDS FOR LARGE VOLUME PACKET NETWORKS Semiannual Technical Report
Howard Frank and Israel Gitman Mar. 1977 89 p refs
(Contract DAHC15-73-C-0135; ARPA Order 2286)
(AD-A039331; SATR-8) Avail: NTIS HC A05/MF A01 CSCL 17/2

Previous NAC data network studies have revealed the fundamental properties and relative costs of a variety of network architecture alternatives. The cost comparisons were made with a constant backbone subnet average end-to-end delay - a crucial performance parameter. Complex line cost structures were created to accurately model existing and projected tariffs. This study focuses on the packet-switched network approach with all users fully integrated in an overall facility sharing plan. Simplifying assumptions are made throughout so that fundamental design decision tradeoffs can be revealed and so that the sensitivities to cost trends brought about by new technologies can be assessed. GRA

N77-29377# Network Analysis Corp., Glen Cove, N. Y.
INTEGRATED DOD VOICE AND DATA NETWORKS AND GROUND PACKET RADIO TECHNOLOGY. VOLUME 3: TOPOLOGICAL GATEWAY PLACEMENT STRATEGIES Semiannual Technical Report
Howard Frank and Israel Gitman Mar. 1977 91 p
(Contract DAHC15-73-C-0135; ARPA Order 2286)
(AD-A039332) Avail: NTIS HC A05/MF A01 CSCL 17/2

Internetwork communication has become an increasingly active area of research in the last few years. However, up to now, most research efforts have been concentrated on the protocol and gateway design issues. The purpose of this study is to investigate the topological design related issues. GRA

N77-29378# GTE Sylvania, Inc., Needham Heights, Mass. Electronic Systems Group, Eastern Div.
SENET-DAX STUDY, VOLUME 1 Final Report, Jun. 1975 - Jun. 1976
25 Jun. 1976 258 p ref 2 Vol.
(Contract DCA100-75-C-0071)
(AD-A039548; FR76-1-Vol-1) Avail: NTIS HC A12/MF A01 CSCL 17/2

The SENET-DAX study investigated the concept of an integrated voice/data switching system using time division multiplexing and dynamic channel allocation; the objectives being: (1) To analyze the feasibility of the SENET-DAX concept in terms of structure and performance characteristic. (2) To address the translation of the concept into candidate hardware and software techniques that could be used to implement the concept. The results of the analysis and techniques studies is presented in these two volumes. Author (GRA)

N77-29379# GTE Sylvania, Inc., Needham Heights, Mass. Electronic Systems Group, Eastern Div.
SENET-DAX STUDY, VOLUME 2 Final Report, Jun. 1975 - Jun. 1976
25 Jun. 1976 262 p refs 2 Vol.
(Contract DCA100-75-C-0071)
(AD-A039549; FR76-1-Vol-2) Avail: NTIS HC A12/MF A01 CSCL 17/2

The concept of an integrated voice/data switching system using time division multiplexing and dynamic channel allocation is explored. The feasibility of the SENET-DAX concept in terms of structure and performance characteristic is analyzed and methods devised for translating the concept into candidate hardware and software techniques for implementation. GRA

N77-29380# BDM Corp., Albuquerque, N. Mex.
GENERAL ELECTROMAGNETIC MODEL FOR THE ANALYSIS OF COMPLEX SYSTEMS. VOLUME 1: USERS MANUAL Final Technical Report, 2 Apr. 1974 - 30 Sep. 1976
R. J. Balestri, T. R. Ferguson, and E. R. Anderson Apr. 1977 184 p
(Contract F30602-74-C-0182)
(AD-A040026; RADC-TR-77-137-Vol-1) Avail: NTIS HC A09/MF A01 CSCL 20/3

Volume I of this report is the user's manual for the GEMACS code developed under this contract. GEMACS utilizes a MOM (Method of Moments) formalism with the EFIE (Electric Field Integral Equation) for the solution of electromagnetic radiation and scattering problems. The code employs both full matrix decomposition and Banded Matrix Iteration solution techniques and is expressly designed for large problems. Volume II of this report describes the engineering approximations, the theory and implementation of the Banded Matrix Iteration scheme, and the results of a wire grid modeling study that established consistent wire grid modeling requirements for large structures.
Author (GRA)

N77-29381# BDM Corp., Albuquerque, N. Mex.
GENERAL ELECTROMAGNETIC MODEL FOR THE ANALYSIS OF COMPLEX SYSTEMS. VOLUME 2: ENGINEERING MANUAL Final Technical Report, 2 Apr. 1974 - 30 Sep. 1976
R. J. Balestri, T. R. Ferguson, and E. R. Anderson Apr. 1977 126 p refs
(Contract F30602-74-C-0182)
(AD-A040027; RADC-TR-77-137-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 20/3
For abstract, see N77-29380.

N77-29382# Army Electronics Command, Fort Monmouth, N.J.
A THEORY OF SCATTERING BY SINUSOIDAL METAL SURFACES
F. Schwering and G. Whitman May 1977 41 p refs
(AD-A040002; ECOM-4496) Avail: NTIS HC A03/MF A01 CSCL 20/3

A rigorous theory of plane wave scattering by periodic metal surfaces is presented. The physical optics approximation is used to determine the current distribution on the metal surface to first order, but this approximate distribution is modified by multiplication with a Fourier series, whose fundamental period is that of the surface profile (Floquet's theorem). The coefficients of the Fourier series are determined by invoking the condition that the field radiated by the current distribution into the lower (shielded) half-space cancels the primary plane wave in this space range. The scatter problem is thereby reduced to the familiar task of solving a system of linear equations. For certain basic types of surface profiles, the coefficients of the linear system are obtained in closed form (Bessel functions for the sinusoidal profiles considered here, and exponential functions for piecewise linear profiles). Thus, the method requires no numerical integral evaluation and, consequently, is computationally efficient. Since the boundary condition of zero tangential electric field at the metal surface is not utilized, the field within the grooves of the periodic scatter need not be known--a definite advantage of the new method. In addition to a summary of the theory, numerical results for TE-, TM-, and circular polarization of the incident plane wave are presented. Author (GRA)

N77-29383# Office of Telecommunications, Boulder, Colo. Inst. for Telecommunications Sci.
AN ANALYSIS OF THE MARITIME HIGH-FREQUENCY SINGLE-SIDEBAND VOICE COMMUNICATION SYSTEM FOR THE NORTH ATLANTIC AND THE SOUTH PACIFIC, VOLUME 1
Jean E. Adams and William A. Kissick Mar. 1977 137 p
(PB-265850/8; OTR-77-113-Vol-1) Avail: NTIS HC A07/MF A01; also avail. in set of 3 reports PC E09, PB-265849-SET CSCL 17B

Frequency trade-off for both the North Atlantic region and the South Pacific region for the world-wide HF voice communication system was studied. A complement of five shore stations for the Atlantic region, six for the Pacific region, and six frequencies (4, 6, 8, 12, 16, and 22 MHz) are considered. Maps of circuit reliabilities and tables of areas of coverage are produced for two each of seasonal, diurnal, and solar activity conditions. Based on these analyses, the 'best' groups of two, three, and four frequencies are identified. The Atlantic region and the Pacific region are considered independently. GRA

N77-29384# Office of Telecommunications, Boulder, Colo. Inst. for Telecommunication Sci.
AN ANALYSIS OF THE MARITIME HIGH-FREQUENCY SINGLE-SIDEBAND VOICE COMMUNICATION SYSTEM FOR THE NORTH ATLANTIC AND THE SOUTH PACIFIC, VOLUME 2
Jean E. Adams and William A. Kissick Mar. 1977 180 p
(PB-265851/6; OTR-77-113-Vol-2) Avail: NTIS HC A09/MF A01; also avail. in set of 3 reports PC E09, PB-265849-SET CSCL 17B
For abstract, see N77-29383.

N77-29385# Office of Telecommunications, Boulder, Colo. Inst. for Telecommunication Sci.
AN ANALYSIS OF THE MARITIME HIGH-FREQUENCY SINGLE-SIDEBAND VOICE COMMUNICATION SYSTEM FOR THE NORTH ATLANTIC AND THE SOUTH PACIFIC, VOLUME 3
Jean E. Adams and William A. Kissick Mar. 1977 188 p
(PB-265852/4; OTR-77-113-Vol-3) Avail: NTIS HC A09/MF A01; also avail. in set of 3 reports PC E09, PB-265849-SET CSCL 17B
For abstract, see N77-29383.

N77-29386# Harry Diamond Labs., Adelphi, Md.
EMPFIT: A COMPUTER CODE FOR FITTING EMP WAVEFORMS THAT FACILITATES THE CALCULATION OF THE FOURIER TRANSFORM
J. Michael Clodfelter Apr. 1977 43 p
(AD-A040019; HDL-TR-1801) Avail: NTIS HC A03/MF A01 CSCL 09/2

The computer code EMPFIT provides a method to fit an electromagnetic pulse, as well as other waveforms, with as little as 15 to 30 points. The code EMPFIT allows the user to fit a smooth curve to the data under consideration and to calculate the Fourier transform. An examination of EMPFIT's capabilities is given along with the procedures for using the code.
Author (GRA)

N77-29387# Army Electronics Command, Fort Monmouth, N.J.
A LOW-PROFILE, REMOTE-TUNED DIPOLE ANTENNA FOR THE 30 TO 80 MHz RANGE Final Report
D. V. Campbell Apr. 1977 36 p
(AD-A040001; ECOM-4491) Avail: NTIS HC A03/MF A01 CSCL 09/5

An experimental low-profile center-fed VHF dipole antenna, which is only one-tenth of a wavelength long, has been investigated. Despite its small height, which facilitates camouflage, a high efficiency-to-size ratio has been achieved. Communications were established over a distance of 34 km between a base station and a mobile unit equipped with the low-profile antenna. Author (GRA)

N77-29388# Naval Postgraduate School, Monterey, Calif.
A CALCULATOR CONTROLLED MICROWAVE NETWORK ANALYZER SYSTEM M.S. Thesis
David K. Young Mar. 1977 166 p refs
(AD-A040014) Avail: NTIS HC A08/MF A01 CSCL 17/2

A Hewlett Packard 8410S (Option 310) Microwave Network Analyzer System and the input/output interface to a Wang 600-14 Programmable Calculator are described. The original design of a digital to analog interface between the Wang 600-14 Calculator and a HP 8690B Sweep Oscillator is presented. Two system software programs which implement automatic S-parameter data collection and either external data storage or data reduction and display are described and documented. Author (GRA)

N77-29389# California Univ., Los Angeles. School of Engineering and Applied Science.
COMMUNICATION METHODS Final Report, 1972 - 1976
K. Yao Dec. 1976 20 p refs
(Contracts N00014-75-C-0528; N00014-69-A-0200-4043)
(AD-A039366; UCLA-ENG-7726) Avail: NTIS HC A02/MF A01 CSCL 09/4

A final report on research activities on ONR contract, 'Communication Methods', covering the period of 1972 to 1976, is presented. Topics of research include digital and analog communication in the presence of interferences; coding of information sources; and models of stochastic processes for signals and noises. A list of research publications and a list of personnel supported in this period are given. A summary of research activities and their relevance is also included.
Author (GRA)

N77-29390# Harvard Univ., Cambridge, Mass. Gordon McKay Lab.
THE BEVERAGE WAVE ANTENNA: CURRENTS, CHARGES AND ADMITTANCES. VOLUME 1: THEORETICAL ANALYSIS EXPERIMENTAL EQUIPMENT AND SYSTEM CALIBRATION
Robert M. Sorbello Feb. 1977 115 p refs
(Contracts F19628-76-C-0057; N00014-75-C-0648)
(AD-A040377; Scientific-1-Vol-1; RADC-TR-77-82-Vol-1) Avail: NTIS HC A06/MF A01 CSCL 09/5

This report presents the results of an experimental and theoretical investigation of the circuit properties of horizontal-wire antennas placed over an imperfectly conducting half-space. Particular emphasis is given to the Beverage wave antenna, a special type of horizontal-wire antenna placed in close proximity to the earth. Earlier work has generally assumed a free-space wave number on the wire, thus neglecting the effect of the half-space. The present study has carefully investigated experimentally the effect of the half-space on the properties of the antenna (current, charge and input admittance) and has included this effect in all theories discussed. GRA

N77-29391# Harvard Univ., Cambridge, Mass. Gordon McKay Lab.
ARRAYS OF BEVERAGE ANTENNAS
R. M. Sorbello, R. W. P. King, K. M. Lee, L. C. Shen, and T. T. Wu Mar. 1977 70 p refs
(Contracts F19628-76-C-0057; N00014-75-C-0648)
(AD-A040380; RADC-TR-77-113) Avail: NTIS HC A04/MF A01 CSCL 09/5

A summary of the research performed on Arrays of Beverage Antennas is presented. It begins with a discussion of the theoretical and experimental determination of the circuit and radiating properties of single horizontal-wire antennas over an imperfectly conducting half-space. This study was reported earlier, in detail, in Scientific Reports Nos. 1 (Vols. 1 and 2) and 2. The antennas are either loaded with a resistor and a quarter-wave section of line to form the modified Beverage antenna or are open-ended. King:s theory for the unloaded antenna is extended to apply to the terminated Beverage antenna. Measurements made on both types of horizontal antenna when placed at varying heights above fresh water, salt water and moist earth are compared with theory. A similar study of the circuit properties of coupled parallel horizontal-wire antennas above an electrically dense dissipative half-space is then reported. GRA

N77-29392# Ohio State Univ., Columbus. ElectroScience Lab.
PARAMETRIC STUDIES OF AN ADAPTIVE ARRAY FOR AM SIGNALS Final Report, 1 Dec. 1975 - 30 Nov. 1976
L. C. Chan and R. T. Compton, Jr. Jan. 1977 35 p
(Contract N00019-76-C-0195)
(AD-A036436; ESL-4326-4) Avail: NTIS HC A03/MF A01 CSCL 09/5

The report presents extensive simulation results for an adaptive array with phase-switched AM signals. The results indicate that the array can provide suitable protection for these AM signals against CW interference. Interference rejection is slightly poorer at certain critical frequencies. However, the system performance is nevertheless still adequate at these frequencies for reliable communications. GRA

N77-29393# Michigan Univ., Ann Arbor. Radiation Lab.
STUDIES IN DIFFRACTION Final Report, 1 Jan. 1972 - 31 Dec. 1976
Thomas B. A. Senior 17 Jan. 1977 15 p
(Grant AF-AFOSR-2262-72)
(AD-A036564; Rept-011075-1-F; AFOSR-77-0067TR) Avail: NTIS HC A02/MF A01 CSCL 20/14

Focuses were on techniques for high frequency scattering determination with particular emphasis on edged bodies. The two main methods are the geometrical theory of diffraction (GTD) and the physical or fringe wave theory (PTD). The former is an extension of geometrical optics through the inclusion of diffracted rays. It requires a knowledge of the diffraction coefficient associated with each local source of diffraction, but is a physically-based theory in which the various parts are actually observable. It is in principle capable of predicting second (and higher) order contributions to the scattering, but in common with all ray techniques it requires the incorporation of matching functions to ensure finite estimates of the fields at caustics where an infinity or rays come together. The second major area was a consideration of material effects in scattering with particular reference to the use of the impedance boundary condition and resistive and conductive sheets in simulating the behavior of absorbers. GRA

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N77-29394 Cornell Univ., Ithaca, N.Y.
SMALL AND LARGE-SIGNAL EFFECTS ON IMPATT DIODES Ph.D. Thesis
Rui Fragassi Souza 1976 165 p
Avail: Univ. Microfilms Order No. 77-8384

The effect of bias, frequency, and RF signal level was measured for silicon single drift IMPATT and read-type structures operating at X-band, but the approach used applies equally well to gallium arsenide diodes operating at different frequency bands. Initially, the theoretical small-signal behavior of IMPATT and Read structures was analyzed and universal-type curves are presented for the chip admittance. These curves are very useful to estimate the avalanche resonant frequency at the operating condition without resorting to special low microwave frequency measurements. On the experimental side, a coaxial reflection amplifier with a singly-tuned circuit was used as a starting point. The circuit admittance transformation factor was measured using a diode perturbation technique and the small and large-signal diode

admittances were determined from the amplifier characteristics, measured up to drive levels well into saturation. Dissert. Abstr.

N77-29395 Princeton Univ., N. J.
RADIATION HARDINESS OF MOS DEVICES AND n-CHANNEL MOS/SOS TRANSISTORS Ph.D. Thesis
Samuel Tuan Wang 1977 154 p
Avail: Univ. Microfilms Order No. 77-7367

The radiation effects of SIO2-insulated MOS devices and n-channel MOS/SOS transistors were investigated. The radiation behavior of control MOS capacitor was studied at both room temperature and liquid nitrogen temperature. It was found that additional positive charges were stored in the oxide as a result of low temperature X-irradiation and that this behaved differently from that induced by room temperature irradiation. The experimental data indicated that the observed effect was not due to ion transport within the oxide. Aluminum ion implantation on oxide charge storage was found to introduce charge trapping centers in the displacement damaged region of the oxide which altered the electrical behavior of implanted MOS capacitors.
Dissert. Abstr.

N77-29396 Florida Univ., Gainesville.
TRANSPORT PROCESSES IN ZINC-SILVER OXIDE BATTERY SEPARATORS Ph.D. Thesis
Maria Norberta Neves Correia DePinho 1976 142 p
Avail: Univ. Microfilms Order No. 77-8213

Diffusion rates were measured using an electrochemical technique; the electrical currents generated were diffusion--controlled. The separator was assumed isotropic. The current-time dependence yielded two asymptotic solutions: (1) Short time solution. The current decreases monotonously with the square root of time. The magnitude of the currents is dependent on the concentration of the electroactive species and the electrode area; it is independent of the separator thickness. (2) Steady-state solution. The currents vary linearly with concentration of the electroactive species, electrode area and reciprocal of separator thickness. Duffusion rates were correlated with measurable geometrical parameters of the porous matrix (thickness and cross-sectional area), electrolyte (concentration of electroactive species), and the effective diffusion coefficient of the separator.
Dissert. Abstr.

N77-29397 Illinois Univ., Urbana-Champaign.
AN INTEGRATED CIRCUIT FAULT MODEL FOR DIGITAL SYSTEMS Ph.D. Thesis
Mark Loren Ketelsen 1976 148 p
Avail: Univ. Microfilms Order No. 77-9054

A model for detecting failure mechanisms in digital networks using integrated circuit devices is proposed. This model, the pin fault assumption, is based on a study of the most frequently encountered failure mechanisms for such networks, and the observation that previous fault assumptions model a large number of faults which occur with low frequency. The basis for the pin fault model, and an investigation of multiple fault detection using this model is presented. Methods for generating test sets for combinational modules and sequential machines are discussed.
Dissert. Abstr.

N77-29398 Virginia Univ., Charlottesville.
LOCAL OSCILLATOR INDUCED NOISE IN SCHOTTKY BARRIER DIODES Ph.D. Thesis
Fung-Sun Fei 1976 124 p
Avail: Univ. Microfilms Order No. 77-7598

The cause and minimization of an oscillator induced noise in Schottky barrier diodes is discussed. Both a theoretical and experimental effort to understand this anomalous noise source have been made, since it presents a fundamental sensitivity limit on mixers. Results show the noise mechanisms consist of thermal noise, shot noise, and intervalley scattering noise. Dissert. Abstr.

N77-29399 Cornell Univ., Ithaca, N.Y.
NONEQUILIBRIUM ELECTRON TRANSPORT IN COMPOUND SEMICONDUCTORS Ph.D. Thesis
Timothy James Maloney 1976 135 p
Avail: Univ. Microfilms Order No. 77-8360

Electron transport in n-type GaAs and InP was investigated with emphasis on nonequilibrium effects using Monte Carlo simulation techniques. By following one electrons through the bandstructure for a long time, or many electrons for a short time the average velocity of electrons for the time immediately following application of a uniform electric is determined. In each material the average velocity overshoots the final, equilibrium velocity during the first few picoseconds of flight for fields above the threshold field for negative differential conductivity. The velocity overshoot curves were used to calculate transit times of electrons under the gate of a field effect transistor (FET) in a simple one dimensional constant field model. Dissert. Abstr.

N77-29400 Florida Univ., Gainesville.
STEADY-STATE THEORY FOR THE METAL-OXIDE-SEMICONDUCTOR FIELD-EFFECT TRANSISTOR Ph.D. Thesis
Richard Frank Motta 1976 168 p
Avail: Univ. Microfilms Order No. 77-8199

A mathematical theory is presented for the steady state operation of a metal oxide semiconductor field effect transistor (MOSFET). The fundamental mechanism on which this model is based requires electric current continuity within the source-drain channel. Both drift and thermal diffusion mechanisms of carrier transport are included and, in the limit of weak inversion operation, the models predict that essentially all source-drain electric current arises from diffusion. Comparisons with rigorous two dimensional computer calculations for the volt-amphere characteristics of a MOSFET indicate that the method satisfactory results for a wide range of device structures and electrical operating conditions. Moreover, throughout both the weak and strong inversion modes of operation, these results are obtained with a single closed-form mathematical relation. Dissert. Abstr.

N77-29401 Purdue Univ., Lafayette, Ind.
CONTROL OF MULTITERMINAL dc SYSTEMS Ph.D. Thesis
Farhad Nozari 1976 128 p
Avail: Univ. Microfilms Order No. 77-7503

A control scheme for parallel multiterminal dc systems is proposed. The scheme is divided into two separate functions: (1) a supervisory control called the system monitor-state predictor (SMSP), which determines the steady state operating point of the system from ac voltage measurements, power requirements at the converters, and the dc network configuration; and (2) the feedback controllers which drive the system to the desired operating point supplied by the SMSP. Systematic methods are presented for computing the optimal and suboptimal feedback controllers. Specific suboptimal controllers are considered in detail and compared with the optimal control, and it is shown that use of local feedback measurements is possible with negligible loss of dynamic performance. Dissert. Abstr.

N77-29402*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SUMMARY OF THE CTS TRANSIENT EVENT COUNTER DATA AFTER ONE YEAR OF OPERATION
N. John Stevens, Vernon W. Klinect, and J. Victor Gore (Communications Research Center, Ottawa) Jul. 1977 28 p refs Presented at the Nucl. and Radiation Effects Conf., Williamsburg, Va., 12-15 1977; sponsored by the Inst. of Elec. and Electron. Engr.
(NASA-TM-73710; E-9249) Avail: NTIS HC A03/MF A01 CSCL 09C

The satellite electrical system Transient Event Counter (TEC) senses and counts transients in three separate satellite wiring harnesses. Recently, anomalous behavior of geosynchronous satellites has been attributed to the electrostatic charging of spacecraft surfaces by the environment during geomagnetic substorm activity, resulting in uncommanded switching of logic circuits. The function of the TEC is to count transients to identify the numbers and distributions of uncommanded pulses capable of switching typical spacecraft logic systems; a large number of transients have occurred without causing any anomalous electronic switching events in the satellite systems. The character of the transients seems to imply that additional sensors are required to understand the discharge phenomenon on large satellites. The results of this experiment indicate that satellite system immunity to discharge related electronic switching anomalies can be obtained by filtering out the harness transients. Author

N77-29403*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
A COMPLEMENTARY DMOS-VMOS INTEGRATED CIRCUIT STRUCTURE Patent Application
Murzban D. Jhabvala, inventor (to NASA) Filed 20 Jul. 1977 23 p
(NASA-Case-GSC-12190-1; US-Patent-Appl-SN-817413) Avail: NTIS HC A02/MF A01 CSCL 09C

A high speed complementary metal oxide semiconductor formed on a single semiconductor substrate includes a diffused metal oxide semiconductor having an asymmetric channel and a V groove, or ion implanting boron into the apex of the V groove and diffusing a single layer to a relatively deep depth along both edges of the groove. NASA

N77-29404*# Westinghouse Electric Corp., Lima, Ohio. Aerospace Electrical Div.
AEROSPACE TECHNOLOGY DEVELOPMENT OF SOLID STATE REMOTE POWER CONTROLLERS FOR 300 VDC WITH CURRENT RATINGS OF ONE AND TWO AMPERES, ONE TYPE HAVING CURRENT LIMITING
W. W. Billings Apr. 1977 182 p ref
(Contract NAS3-20083)
(NASA-CR-135199; WAED-77-01E) Avail: NTIS HC A09/MF A01 CSCL 09C

Two types of transistor remote power controllers for spacecraft distribution systems have been developed, built, and fully tested. Simple, efficient, reliable and relatively low cost designs are described with test results. Each design provides overcurrent protection through an inverse trip out function with a fail safe device back up. All designs have demonstrated step applied fault capability with a fast risetime power source. They have also been demonstrated for power quality, transient immunity, and compatibility with anticipated loads. Author

N77-29405*# Westinghouse Electric Corp., Lima, Ohio. Aerospace Electrical Div.
AEROSPACE TECHNOLOGY DEVELOPMENT OF THREE TYPES OF SOLID STATE REMOTE POWER CONTROLLERS FOR 120 VDC WITH CURRENT RATINGS OF FIVE AND THIRTY AMPERES, ONE TYPE HAVING CURRENT LIMITING Technical Report, Jul. 1973 - May 1977
J. T. Mitchell Apr. 1977 372 p
(Contract NAS3-17771)
(NASA-CR-135216; WAED-77-05E) Avail: NTIS HC A16/MF A01 CSCL 09C

Three types of transistor remote power controllers for spacecraft distribution systems have been developed, built and fully tested. Simple, reliable, efficient and relatively low cost designs are described with test results. Each design provides an inverse, trip-off protection for overloads. All designs have demonstrated compatibility with 4000 ampere, low inductance sources and comply with basic requirements. These highly miniaturized units feature mounting tabs for efficient heat transfer to the heat sinks. Inverted type construction provides top located terminals for easy wiring access. These units are hermetically sealed and of flight worthy quality. Author

N77-29406# Rome Air Development Center, Griffiss AFB, N.Y.
FAA LIGHTNING PROTECTION STUDY: LIGHTNING-INDUCED TRANSIENTS ON BURIED SHIELDED TRANSMISSION LINES: NUMERICAL ANALYSIS AND RESULTS Final Report, May 1976 - May 1977
John D. Nordgard (Georgia Inst. of Technol., Atlanta) and Chin-Lin Chen (Purdue Univ., West Lafayette, Ind.) May 1977 118 p refs
(Contract DOT-FA72WAI-353)
(AD-A041319; FAA-RD-77-83) Avail: NTIS HC A06/MF A01 CSCL 09/1

Induced transient current and voltage pulses on buried shielded transmission lines, due to earth conduction effects of nearby lightning discharges are analyzed. A numerical method is presented for determining the amount of coupling between a lightning discharge to ground and an earth-return transmission line. The transmission line is assumed to be a long straight horizontal coaxial cable with an inner shield and an outer armor, terminated on both ends with typical communication equipment load impedances. The general case is considered here, in which the outermost conductor is not necessarily in perfect contact with the conducting earth but has a contact impedance with the earth, as in cables with an outer dielectric covering for corrosion or water protection. Indirect strikes to the cable via conductive coupling mechanisms through the earth are considered. Several average lightning channel conditions and several representative buried cable geometries are examined. The results are displayed via graphs of the time histories and frequency spectra of the resulting transient current and voltage surges. Author

N77-29407# Rome Air Development Center, Griffiss AFB, N.Y.
VACUUM TUBE AVAILABILITY ASSESSMENT PROGRAM. VOLUME 2: FAA TUBE/EQUIPMENT LISTS Final Report, Oct. 1976 - Mar. 1977
G. K. Huddleston (Georgia Inst. of Technol., Atlanta) Mar. 1977 191 p
(Contract DOT-FA72WAI-356)
(AD-A041309; FAA-RD-77-27-Vol-2) Avail: NTIS HC A09/MF A01 CSCL 09/1

Alphanumeric lists of vacuum tubes and equipments used by the FAA are presented to assist in identifying specific pieces of equipment which may be affected by a shortage of a particular tube type. Each of the two lists indicated the type and number of tubes required for each piece of equipment. Author

N77-29408# Sandia Labs., Albuquerque, N. Mex.
FIELD PENETRATION BY DIFFUSION INTO A CONDUCTING SHELL
Garth L. Maxam Feb. 1977 31 p refs
(Contract EY-76-C-04-0789)
(SAND-77-0033) Avail: NTIS HC A03/MF A01

Low frequency currents induced in a conducting shell by lightning or some other excitation excite significant electromagnetic fields by diffusion inside the shell. Aircraft and missiles on the ground are particularly susceptible to lightning. A technique to predict internal fields due to an external excitation is set forth. The analytical procedure involves three steps: prediction of the external current distribution on the shell by wire grid modeling techniques, estimation of the inside current distribution by multiplying the exterior current distribution by a skin depth factor, and calculation of the magnetic field by use of vector potential integral. The procedure has been partially verified by laboratory experiment. ERA

N77-29409# California Univ., Livermore. Lawrence Livermore Lab.
TIME-DOMAIN MODELLING OF NONLINEAR LOADS
J. A. Landt (Los Alamos Scientific Lab., N. Mex.), E. K. Miller, and F. J. Deadrick 29 Sep. 1976 28 p refs
(Contract W-7405-eng-48)
(UCRL-52172) Avail: NTIS HC A03/MF A01

The behavior of an antenna or scatterer when loaded with a nonlinear impedance can be changed greatly from that observed under linear conditions. In some cases, the nonlinearity causes detrimental effects, such as the intermodulation products arising from the nonlinear mixing of two frequencies. In other cases, the nonlinearity may be exploited profitably, e.g., to reduce late-time ringing on a pulse-excited antenna. A procedure for treating general nonlinear loads is described and applied through a computer program to several specific types of nonlinearities. The treatment is developed within the framework of the thin-wire approximation to the electric-field integral equation and can be applied to the large class of objects modeled by wires. The nonlinear load types that are considered include those with piecewise-linear voltage-current curves, a load with a time-varying impedance and a general nonlinear load represented by specified voltage-current functions. ERA

N77-29410# I-T-E Imperial Corp. Research, Colmar, Pa.
SYNCHRONOUS TRANSMISSION CIRCUIT BREAKER DEVELOPMENT Final Report
R. D. Garzon Aug. 1976 196 p refs
(Contract E(49-18)-2155)
(CONS-2155-1) Avail: NTIS HC A09/MF A01

The need for the development of a synchronous transmission breaker is discussed and the basic preliminary specifications for such a circuit breaker are established and tabulated. The initial

exploratory work designed to establish the preferred designs for a synchronous pulse generator, for an operating mechanism and for a suitable interrupter are described in detail. The experimental results obtained with vacuum interrupters and with axial blast interrupters using pure SF6, mixtures of SF6 and N2, and high pressure liquid SF6 are reported. The results are then evaluated and the performances obtained with each interrupting media are compared arriving at the end to a choice of a preferred design. This preferred design, an interrupter that uses SF6 in the liquid state at pressures of 13.8 megapascals (2000 psi), is completely described. The results obtained in a series of experiments designed to establish limits of performance for this interrupter are also discussed. ERA

N77-29411# Phoenix Electric Corp., Boston, Mass.
DEVELOPMENT OF CURRENT LIMITING CONDUCTOR Final Report
O. J. Albani, T. F. Clark, and H. M. Pflanz Feb. 1977 228 p refs
(EPRI Proj. 324-1)
(EPRI-EL-286) Avail: NTIS HC A11/MF A01

The theory of the current limiting conductor (CLC) is developed and confirmed by experiments. In principle the CLC is a linearly-extended solenoid whose inductance increases as the air gap between the armature and the core is reduced by magnetic forces resulting from the short circuit current. Design formulae for the CLC concept are developed. The nonlinear interaction of the electric circuit, magnetic circuit, and the mechanical system is analyzed. Both steady state and transient solutions are obtained. A peculiar beat pattern of the limited current was observed and mitigated by increasing the losses of the CLC. Analysis suggested switching a resistor into the circuit. The term CLC with resistor was coined and commutation of current to the resistor explored. A cost analysis indicates that inclusion of the resistor may reduce the cost of the CLC by 90%. The trade-off is complexity. Fractional CLC devices with and without resistor were designed. ERA

N77-29412# Amerace Corp., Hackettstown, N. J. Elastimold Div.
THE 138 kV SPLICE FOR EXTRUDED DIELECTRIC CABLES Final Report
Robert G. Fisher Feb. 1977 151 p refs
(Contract E(49-18)-1559; EPRI Proj. 7815)
(EPRI-EL-354) Avail: NTIS HC A08/MF A01

A straight splice for 138 kV extruded dielectric cable was developed. It passed all the design requirements and is ready for a prolonged trial simulating an actual installation. The splice makes use of premolded, interference-fit, elastomeric components that can be factory tested (to guarantee their integrity) before they are installed, thereby increasing the reliability of the system. The corona extinction level of 120 kV (5 pc) and dielectric losses of the splice were unaffected by cyclic loading up to 130 C when stressed at 1.5 times normal line to ground voltage. Capacitance and power factor were in the order of 195 picofarads and 0.25% respectively. The two splices with the conductors at 90 C withstood 5 positive and 5 negative 1.5 x 50 microsecond impulses at 650 kV, both before and after load cycling. ERA

N77-29413# California Univ., Berkeley. Lawrence Berkeley Lab.
ELECTRICAL CONDUCTION IN METAL-GLASS COMPOSITE MATERIALS
V. K. Nagesh Jun. 1976 35 p refs
(Contract W-7405-eng-48)
(LBL-5172) Avail: NTIS HC A03/MF A01

The importance of the surface characteristics of the glass phase used in the development of conducting thick film systems was investigated. The system studied was the lead borosilicate glass-silver system. By surface activation of the glass particles, a conducting thick film microstructure was developed using a reduced amount of silver compared to commerical compositions. Thick films with resistivities of the order of 75 milliohms/square (m omega square) with a silver content of 30 wt.% (w/o) was obtained. The resistance is comparable to the 50 milliohms/square obtained with 80 wt.% Pt in Pt-Pd commercial systems. ERA

N77-29414# Heimann G.m.b.H., Wiesbaden (West Germany).
TECHNICAL FEASIBILITY OF THERMAL IMAGE TUBES WITH PYROELECTRIC TARGETS [MOEGLICHKEITEN ZUR TECHNISCHEN REALISIERUNG VON WAERMEBILDROEHREN MIT PYROELEKTRISCHEN TARGETS]
P. W. Steinhage Bonn DOKZENTBw 1976 53 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(BMVg-FBWT-76-27) Avail: NTIS HC A04/MF A01; DOKZENTBw, Bonn DM 30

Several experimental setups and IR optical equipment were constructed and the concept of an IR image test device is described. Various types of sealed off tubes were produced and tested in order to find a target mounting with a possibly low stray capacitance. Some tubes were filled with argon with a pressure of 0.001 torr to operate in a continuous cathode potential stabilizator (CPS). A temperature resolution of 0.6 K was achieved in CPS mode by using a mirror objective with an f-number of 0.8. The highest spatial resolution was found to be 6 LP/mm, limited only by the thermal conductibity of the target material. Author (ESA)

N77-29415# Siemens A.G., Erlangen (West Germany).
ELECTRICAL CONDUCTION AND ELECTRICAL BREAKDOWN OF ORGANIC INSULATORS AND SEMICONDUCTORS Final Report
Helmut Ahne, Bernhard Andress, Kurt Nissen, and Peter Roehl Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1976 141 p refs In GERMAN; ENGLISH summary
(Contract BMFT-NT-4339-A)
(BMFT-FB-T-76-56) Avail: NTIS HC A07/MF A01; ZLDI, Munich DM 29.60

The results of electrical measurements performed on characterized polyethylenes allow formulation of a simplified picture of the conduction mechanism. The conduction current results from electrode-injected electrons and leads to the build-up of a long-lived space charge. Initially the electronic contribution is superposed by a dipolar polarization current, the latter also giving rise to the discharge currents observed. The space charge built up, especially in the presence of impurities and defects, may well influence the electrical breakdown while the material's breakdown strength, of about 800 kV/mm, is relatively unaffected by external parameters. Author (ESA)

N77-29416# AEG-Telefunken AG, Belecke (West Germany). Fachgebiet Leistungshalbleiter.
NEW TECHNOLOGIES FOR SILICON POWER DEVICES: TURN-OFF BEHAVIOR OF THYRISTORS Final Report
Edgar Borchert Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1976 109 p refs In GERMAN; ENGLISH summary
(Contract BMFT-NT-446-b)
(BMFT-FB-T-76-64) Avail: NTIS HC A06/MF A01; ZLDI, Munich DM 22.90

The forced commutation behavior of thyristors with an inductive load is dealt with. The turn-off energy loss and other reverse recovery properties were investigated taking into consideration several device parameters including conductivity type of main base, weakly n-doped s(n), or weakly p-doped s(p). Contrary to diodes, the turn-off behavior of the s(p) thyristor does not differ essentially from that of the s(n) thyristor. In particular, due to the injection of minority carriers, s(p) thyristors exhibit reverse current tail-off similar to s(n) thyristors instead of snap-off which can be exhibited by s(p) diodes. Author (ESA)

N77-29417# AEG-Telefunken, Frankfurt am Main (West Germany).
NEW TECHNOLOGIES FOR SILICON POWER DEVICES. STRUCTURES WITH HIGH TURN-OFF AMPLIFICATION Final Report [NEUE TECHNOLOGIEN FUER SILIZIUM-LEISTUNGSBAUELEMENTE. STRUKTUREN MIT HOHER AUSSCHALTVERSTAERKUNG]
Friedhelm Sawitzki Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1976 64 p refs In GERMAN; ENGLISH summary
(Contract BMFT-NT-446)
(BMFT-FB-T-76-65) Avail: NTIS HC A04/MF A01; ZLDI, Munich DM 13.45

An investigation is reported of pnpn structures which can be switched by a negative gate current pulse from the conducting

into the forward blocking state. To obtain a high turn-off gain, the current amplification factor of the pnp part of the structure was lowered by reduction of the transport factor and the emitter efficiency. This was achieved by in-diffusion of gold recombination centers and by thinning of the p emitter zone until a surface acceptor concentration of 10 to 17th power/cu cm is obtained at the recombination contact. Since both steps enhance the turn-on voltage, a compromise between turn-off and turn-on voltage must be made. For improvement of the conduction behavior, a switching variant was developed in which the forward conduction voltage was reduced by a positive gate current. Author (ESA)

N77-29418# Siemens A.G., Munich (West Germany). Unternehmensbereich Bauelemente.

GAS PHASE DEPOSITION OF INSULATING FILMS Final Report

Reinhard Behn, Horst Hagedorn, Johann Kammermaier, Manfred Kobale, Horst Pachonik, Dieter Ristow, and Gerhard Seebacher Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1976 55 p refs In GERMAN; ENGLISH summary

(Contract BMFT-NT-458)

(BMFT-FB-T-76-66) Avail: NTIS HC A04/MF A01; ZLDI, Munich DM 18.50

Organic dielectric films (with a thickness down to 100 nm) could be deposited on metallized carrier foils in a continuous process by glow discharge in monomer gases. Depending on the applied monomers, the films had a dissipation factor of 0.001 to 0.003 (1kHz), a relative permittivity of 2.3 to 2.5 and a resistivity of about 10 to 17th power ohm cm. Moreover, they proved to have a very high dielectric strength (up to 800 V/micron) and good mechanical homogeneity. Self-healing rolled capacitors with a very high capacitance per volume and of consistently high quality (68 microF/cu cm) were manufactured from the metallized carrier foils covered with the deposited dielectric film. Author (ESA)

N77-29419# Siemens A.G., Munich (West Germany).

LIQUID CRYSTALS (NEMATICS) Final Report

Waldemar Greubel and Hans Krueger Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1976 75 p refs In GERMAN; ENGLISH summary

(Contract BMFT-NT-52-1)

(BMFT-FB-T-76-69) Avail: NTIS HC A04/MF A01; ZLDI, Munich DM 15.75

Results of work on liquid crystals are presented in the following fields: liquid crystal matrix display with ferroelectric ceramic, uniform surface alignment of thin liquid crystal layers, storage effect in cholesteric liquid crystals, investigations of nematic liquid crystals with negative dielectric-anisotropy, and methods for constructing large area liquid crystal displays. Author (ESA)

N77-29420# Siemens A.G., Munich (West Germany). Unternehmensbereich Bauelemente.

LIQUID CRYSTALS Final Report

Karl-Heinz Walter, Walter Geffcken, Waldemar Greubel, Manfred Kobale, Helmut Krueger, Ekke Reichel, Christoph Rotter, Miroslav Tauer et al Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1976 119 p refs In GERMAN; ENGLISH summary

(Contract BMFT-NT-52-2)

(BMFT-FB-T-76-71) Avail: NTIS HC A06/MF A01; ZLDI, Munich DM 25.20

The development of an information display with liquid crystals is reported. One starting concept was to use ferroelectric layers for decoupling. It was of advantage and easier to achieve high element density by using liquid crystals with memory effect. The result was a liquid crystal matrix with 16000 elements (0.5 x 0.5 sq mm each) which operates with bistability-effect in an erase-write mode suited to displaying graphic and alphanumeric characters. Circuit-concepts for integration of driver elements are elaborated. Technological problems in achieving the matrix, as well as other liquid crystal displays such as surface-cleaning, surface-alignment, sealing and aging processes are treated. Author (ESA)

N77-29421# Istituto Elettrotecnico Nazionale (Galileo Ferraris), Turin (Italy).

REALIZATION OF A PRIMARY VOLTAGE STANDARD BASED ON THE JOSEPHSON EFFECT AT THE IEN [ATTENUAZIONE DI UN CAMPIONE PRIMARIO DI TENSIONE A EFFETTO JOSEPHSON PRESSO L'IEN]

Domenico Andreone, Ernesto Arri, and Giancarlo Marullo Jun. 1975 44 p refs In ITALIAN

(IENGF-RT-252) Avail: NTIS HC A03/MF A01

Experimental equipment and measurement procedures are described which are used in developing a primary voltage standard based on the ac Johnson effect in order to link the national voltage unit to the universal constant 2 e/h. Use was made of niobium point Josephson junctions producing a voltage of about 1 mV. This voltage was measured in national units by comparison with the EMF of saturated batteries. The relation between the two voltages is determined by equilibrium in voltage drop over two resistors of 1 ohm and 1000 ohm in an oil bath through which the same current runs. ESA

N77-29422# Centre National d'Etudes Spatiales, Toulouse (France).

STUDY OF Au-Al INTERMETALLICS EVOLUTION LAWS AND QUALITY CONTROL METHODS [CONTRIBUTION A L'ETUDE DE COMPOSES INTERMETALLIQUES Au-Al - LOIS D'EVOLUTION ET METHODE DE DEVERMINAGE]

Daniel Hernandez Feb. 1977 43 p In FRENCH; ENGLISH summary

(CNES-NT-67) Avail: NTIS HC A03/MF A01

The main conclusions of a study conducted on the gold-aluminum intermetallics observed with transistors and special test samples are presented. The influences of several stresses (current, temperature, dissipated power...) were studied across the electrical parameters, the bondings' visual aspect and pull strength of the parts tested. Several laws of evolution were established for the lots of tested parts. Author (ESA)

N77-29423# Laboratoires d'Electronique et de Physique Appliquee, Paris Limeil-Brevannes (France).

EVALUATION OF GaAs IMPATT DIODES WITH HIGH EFFICIENCY FOR SPACE APPLICATIONS Final Report [EVALUATION DE DIODES IMPATT A HAUT RENDEMENT EN GaAs POUR APPLICATIONS SPATIALES]

Boucher, Farrayre, Hybois, Jarousse, Ranneau, and Touratier Mar. 1977 74 p refs In FRENCH

(Contract ESTEC-2498/75-AK)

(ESA-CR(P)-935) Avail: NTIS HC A04/MF A01

A reliability analysis of epitaxial GaAs IMPATT diodes for space applications is presented. The diodes were subjected to mechanical and climatic tests according to MIL STD 750 B. Long term reliability was evaluated using accelerated life tests. The median of the failure distribution function (assimilated with a lognormal law) is 10000 hours at Tj = 180 C. This temperature corresponds to the operating conditions at 40 C ambient temperature of a monomesa diode producing 1.65 W at 11.2 GHz with 18% efficiency. Quadrimesa technology and similar ambient conditions lead to a median of 10 million hours. Error rate is 100 FIT: a value compatible with space applications. The main degradation mechanism is diffusion of the platinum barrier leading to drift of the characteristics. ESA

N77-29424# European Space Agency, Paris (France).

MODELLING OF QUARTZ OSCILLATORS

Patrick Bressy Jun. 1977 139 p refs Transl. into ENGLISH of 'Modelisation des Oscillateurs a Quartz', ONERA, Paris Report ONERA-NT-1976-13, 1976 Original report in FRENCH previously announced as N77-25432

(ESA-TT-384; ONERA-NT-1976-13) Avail: NTIS HC A07/MF A01

Any improvement of the quality of quartz frequency standards requires a thorough study of all oscillator parameters, the fluctuations of which, random or not, may cause a degradation of frequency stability due to either the resonator or the oscillator electronics. Only the latter was considered; an attempt was made to establish as complete a modelization as possible of the oscillator active circuits and to demonstrate its validity. It is the oscillator starting period that permits an efficient verification of the model validity. Direct treatment of the oscillator differential equations does not, in practice, yield the solution describing the whole transient regime, mostly because of the very high value of the resonator quality factor. A mathematical model using the theories

of the first harmonic and of perturbations permits emphasizing the frequency and amplitude variations of the signal during the whole transient regime. The oscillator studied was of the Pierce type. Of the two models considered, the first reduces the oscillator electronics to a single voltage amplifier with a nonlinear characteristic of quadratic type, the second makes use of the Ebers and Moll transistor model. The excitation level of the quartz being particularly high in this type of oscillator, it is necessary to introduce in the resonator equivalent scheme nonlinear parameters, provoking a frequency shift in the sense opposite to that resulting from the amplifying unit. Thus, through an appropriate choice of the shape of the nonlinear characteristic of the active circuit, the frequency variations caused by the fluctuations of the oscillation amplitude can be attenuated.
Author (ESA)

N77-29425# RCA Corp., Burlington, Mass. Automated Systems.
ADVANCED DEVELOPMENT AN/USM-410 (XE-3) (V) ELECTRONIC EQUIPMENT TEST STATION (EQUATE) Final Report, 22 May 1975 - Nov. 1976
R. P. Percoski Feb. 1977 135 p refs
(Contract DAAB07-75-C-1338)
(AD-A038287; ECOM-75-1338-F) Avail: NTIS HC A07/MF A01 CSCL 14/2

A third-generation Automatic Test Equipment (ATE) has been developed with the capability for functional test and diagnostic fault isolation testing of a wide variety of electronic assemblies, subassemblies and modules. A brief history of ATE is given leading to the initial development of the EQUATE (Electronic Quality Assurance Test Equipment) system, which was later assigned the official nomenclature of AN/USM-410 (V). Advanced development of the EQUATE system has focused on the expansion of low-frequency stimulus/measurements capability to 500 MHz, improvements in RF/microwave capability for stimulus/measurement extension to 18 GHz, and development of a fully programmable interface. The addition of a Programmable Interface Unit (PIU) where each pin can be configured as a stimulus, analog/digital measurement, or load point, includes dynamic digital test capability at rates up to 2 MHz. The result of this development is the AN/USM-410 (XE-3) (V) Test Station, capable of functional and diagnostic fault isolation testing of analog, analog/digital and purely digital electronic assemblies, subassemblies and modules. Author (GRA)

N77-29426# Indiana Univ., Bloomington. Dept. of Chemistry.
SPECTRAL AND NOISE CHARACTERISTICS OF A 300-W EIMAC ARC LAMP
Ronald L. Cochran and Gary M. Hieftje 15 May 1977 24 p
(Contract N00014-76-C-0838)
(AD-A039794; TR-4) Avail: NTIS HC A02/MF A01 CSCL 20/6

High-pressure xenon short-arc lamps have long been considered to be reliable, high intensity sources of radiation for the ultraviolet, visible, and near-infrared spectral regions. The Eimac illuminator series, which Varian began marketing in 1972, is a variant of the conventional short arc lamp, having an integral parabolic (or elliptical) reflector, which provides greatly improved light gathering efficiency over more simple arc lamps. The integral reflector also significantly simplifies lamp alignment. GRA

N77-29427# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
DETECTION OF ELEMENTARY PROCESSES WITHIN POROUS ELECTRODES Interim Report
S. Szpak 18 Apr. 1977 19 p refs Submitted for publication
(Contract N00014-73-C-0397)
(AD-A038915; LMSC-D558466; TR-5) Avail: NTIS HC A02/MF A01 CSCL 10/3

The interaction of elementary processes within the confines of porous structures is simplified by application of concepts such as penetration depth and a structural unit characteristic of porous electrodes. A systematic approach to the determination of relevant processes and specification of electrode structure is presented. Both experimental and mathematical analogs are used. Author (GRA)

N77-29428# Army Electronics Command, Fort Monmouth, N.J.
MODULATOR - REPETITIVELY PULSED FIELD EMISSION ELECTRON BEAM GUN INTERFACE
George J. Dezenberg, William Wright, and Sol Schneider Apr. 1977 10 p
(AD-A039460; ECOM-4489) Avail: NTIS HC A02/MF A01 CSCL 09/5

A field emission electron beam gun is repetitively pulsed with a modulator in a Blumlein arrangement. The modulator is operated in an unmatched condition with the output connected directly to the gun. The gun is a time varying monotonically decreasing impedance load while the modulator impedance is constant. The modulator-gun configuration produces an initial voltage peak which approaches twice the value of the charge voltage to promote gun emission. After the initial peak, the load voltage assumes a value determined by the gun impedance. Peak voltages in excess of 350 kV and peak currents up to 8 kA have been delivered in 5 microseconds pulses by the modulator to the gun. The modulator routinely operates at 50 Hz repetition rate, 135 kV recharge voltage and about 3 amps of average current. Author (GRA)

N77-29429# Spacetac, Inc., Bedford, Mass.
DEVELOPMENT, FABRICATION AND SERVICE OF INSTRUMENTS FOR USE IN ELECTRICAL STRUCTURES AND RELATED SPACE FLIGHT MEASUREMENTS Final Report, 30 Oct. 1974 - 31 Jan. 1977
John W. Zukauskis, Bernard B. Hurwitch, Paul D. Murray, and Robert C. Vaillancourt Hanscom AFB, Mass. AFGL 28 Feb. 1977 31 p
(Contract F19628-74-C-0218)
(AD-A040040; AFGL-TR-77-0056) Avail: NTIS HC A03/MF A01 CSCL 09/5

The goals established at the onset of this program were fivefold: (1) design and fabricate a spherical electron, (2) design and fabricate a planar ion sensor, (3) design and fabricate a multioutput low voltage power converter, (4) design and fabricate digital interface electronics incorporating a nine bit successive approximation analog to digital converter, and (5) design and build suitable ground support equipment for the thorough testing and characterization of the DMSP SS/IE plasma electronics package. The most noteworthy achievement concerns the variety of both designs and assembly techniques tried and subsequently rejected in the early phases of the planar and the spherical sensor development. This particular development effort graphically pointed out two (2) pertinent things which generally apply for these types of sensors. These are (1) the simpler a design can be made the more reliable and reproducible the finished product is and (2) these types of sensors require the close supervision or support of the mechanical design by an electronics engineer familiar with the problems and the electrical techniques associated with high sensitivity electrometer instrumentation. GRA

N77-29430# Hughes Research Labs., Malibu, Calif.
MILLIMETER WAVE UBITRON DEVELOPMENT, PHASE 1 Final Technical Report, 8 Mar. - 31 Dec. 1976
J. M. Baird, S. Sensiper, K. Amboss, and John F. Heney Apr. 1977 208 p refs
(Contract F30602-76-C-0215)
(AD-A040043; RADC-TR-77-133) Avail: NTIS HC A10/MF A01 CSCL 09/5

The theory of Ubitrons (Undulating Beam Interactions) for high power millimeter wave amplification is reviewed and extended. Relativistically correct dc and small-signal theories are developed and applied to a 94-GHz, 50-kW Ubitron amplifier. GRA

N77-29431# Office of Telecommunications, Boulder, Colo. Inst. for Telecommunications Science.
PULSE DISTORTION IN COAXIAL CABLE
Allen Q. Howard Feb. 1977 41 p refs Sponsored in part by Army Communications Command
(PB-266659/2; OTR-77-111) Avail: NTIS HC A03/MF A01 CSCL 09A

A review and discussion which considers the limitations of conductivity-induced distortion in coaxial cable is presented. The

theory is then applied to several pulse shapes including rectangular, Gaussian, and raised cosine. These results are presented graphically as universal families of amplitude versus time for several values of Nahman's beta. A general expression for periodic function distortion is obtained and used to evaluate pulse tail build up. Pulse rate degradation as a function of beta for rectangular and Gaussian pulses follow. Some limitations of the theory as well as recommended extensions are given. GRA

N77-29432# Army Missile Command, Redstone Arsenal, Ala. Guidance and Control Directorate.
TRANSIENTS ON A LOSSLESS, EXPONENTIALLY-TAPERED TRANSMISSION LINE
David Mathews 30 Dec. 1976 13 p
(AD-A036563; RG-77-5) Avail: NTIS HC A02/MF A01 CSCL 09/1

A solution for the problem of a voltage pulse propagating along a lossless, exponentially-tapered transmission line is presented in the form of a convolution integral. If the input pulse can be approximated in terms of simple functions, an analytical solution is possible. If not, numerical evaluation of the resulting integral is still much simpler than solving the differential equations of propagation. GRA

N77-29433# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
A COMPUTER PROGRAM TO DETERMINE THE RESISTANCE OF LONG WIRES AND RODS TO NONHOMOGENEOUS GROUND
Steven A. Arcone Jan. 1977 21 p refs
(DA Proj. 4A7-62719-AT-33)
(AD-A036250; CRREL-77-2) Avail: NTIS HC A02/MF A01 CSCL 20/3

A computer program was developed for finding the d-c resistance to ground of two simple electrodes, a straight horizontal wire and a vertically driven rod. The objective of this study was to develop a rapid means of finding the resistance to ground of simple electrode types in arctic environments where a two-layer earth model, frozen and unfrozen ground, is applicable. The program can consider homogeneous as well as two-layer earth, and the length, diameter and position of the electrodes. The computations were performed first by dividing an electrode into several smaller segments. Next the electrostatic potential of each segment was computed at the center of the electrode for unit-applied current. The segment potentials were then summed to find the total resistance to ground. Some specific computations are presented in comparison with previous theoretical work of other authors. The following conclusions were made: (1) A maximum run time of 165 seconds is needed for all two-layer arctic models where (a) the depth of the upper layer does not exceed 10 m, (b) the vertical rod length is less than 30 m, or (c) the horizontal wire length is less than 100 m; (2) Best accuracy is obtained when rod and wire radii are less than 0.01 m; and (3) Coincidence of the center of the vertical electrode with the two-layer interface must be avoided.
Author (GRA)

N77-29434# Harry Diamond Labs., Adelphi, Md.
A STUDY OF FINEBLANKING FOR THE MANUFACTURE OF FLUERIC LAMINAR PROPORTIONAL AMPLIFIERS
R. Michael Phillippi May 1977 23 p refs
(DA Proj. 1T1-61102-AH-44)
(AD-A040230; HDL-TM-77-8) Avail: NTIS HC A02/MF A01 CSCL 09/5

A nonconventional stamping process, known as fineblanking, is investigated for use in high-volume production of flueric laminar proportional amplifiers. The investigation includes the standard deviation of critical dimensions, supply and control flow measurements for a constant pressure, amplifier gain, common-mode rejection ratio (CMRR), and cost breakdown. The present study indicates that fineblanking yields a significant improvement over metal photochemical etching (a widely used fabrication technique) in the repeatability of geometric parameters. Typical standard deviations of a nozzle width are less than 0.5 percent. Further, a 61.3-percent improvement of the mean CMRR was observed. Author (GRA)

N77-29435# Breuer and Associates, Encino, Calif.
FUNCTIONAL LEVEL MODELING OF COMPLEX ELEMENTS IN TEST/80
Melvin A. Breuer 1 Sep. 1976 81 p
(Contract N00014-75-C-1053; NR Proj. 048-631)
(AD-A040269; TEST/80-1-76) Avail: NTIS HC A05/MF A01 CSCL 09/5

This report documents the result of just one task of our contract. This task was to investigate the feasiblity of handling complex elements functionally, rather than at the logic level, in an ATG system. We have assumed a test generation system based upon the concepts of path sensitization a la the D-alorithm. In this report we demonstrate this feasiblity. More precisely, we have developed function models for three devices (a flip-flop, a counter, and a shift register). These models include mechanisms for processing implication, D-drive and line justification. We introduce concepts for dealing with both edge-triggered and level devices, as well as a generic language for specifying the functional operation of a device. Author (GRA)

N77-29436# Breuer and Associates, Encino, Calif.
AN ADVANCED AUTOMATIC TEST GENERATION SYSTEM FOR DIGITAL CIRCUITS
Melvin A. Breuer 29 Mar. 1977 112 p
(Contract N00014-75-C-1053; NR Proj. 048-631)
(AD-A040271; TEST/80-1-77) Avail: NTIS HC A06/MF A01 CSCL 09/5

This is the third and final report documenting our research into the design of a new and powerful automatic test generation system for digital logic, called TEST/80. This system is designed around the following six concepts. 1. A powerful circuit preprocessing analysis which leads to greater efficiency during stimulus generation. 2. An effective initialization algorithm. 3. The use of time frames, phases and periods so that asynchronous circuits can be accurately processed during stimulus generation. 4. The use of functional level primitives so that complex circuits including shift registers, counters and RAM's, can now be effectively processed. 5. The use of a stimulus generation algorithm which incorporates the concepts in 1-4. 6. The use of a functional level concurrent fault simulator, used to grade a test and produce a fault dictionary. GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N77-29437 Polish Academy of Sciences, Warsaw.
AN OPTIC METHOD OF MEASURING DISTRIBUTION OF CONCENTRATIONS OF A DROPLET SUSPENSION IN PASSAGE THROUGH A TUBE [OPTYCZNA METODA POMIARU ROZKLADU KONCENTRACJI ZAWIESINY KROPLOWEJ W PRZEPLYWIE PRZEZ RURKE]
Tomasz Kowalewski Dec. 1976 49 p refs In POLISH
Avail: Issuing Activity

Concentration profiles of a droplet suspension are measured by light absorption; this method can be used for both low and high concentrations of suspensions. Measurement results confirm that the vicinity of the wall of the tube through which the suspension passes, a layer of reduced concentration of particles form, and that formation of this layer is connected with the entrance region of the tube. Also confirmed is the accumulation of particles in droplet suspension, probably as a result of their radial migration analagous to the migration of individual droplets. Author

N77-29438 Minnesota Univ., Minneapolis.
NUMERICAL SIMULATION OF VISCOUS FLOW WITH A FREE SURFACE
Franklin Mattes Orr, Jr. 1976 234 p
Avail: Univ. Microfilms Order No. 77-7034

A key feature of any approximate method for free surface

flows is the way in which the free surface is represented. It is convenient to represent the surface as an expansion in locally defined polynomial trial functions. The expansion is then used in the finite element method to solve the nonlinear, elliptic Laplace-Young equation. Solutions are presented for the three-dimensional meniscus which forms between cylinders of circular and square cross section standing on an infinite square array in a pool of liquid. An iterative scheme is devised for the more difficult, and previously unsolved, class of free boundary meniscus problems which occur when the solid cross-sectional shape depends on elevation, and solutions for cones and spheres in a pool are given. The finite element method is then used to solve the Navier-Stokes equations for the flow of a liquid film inside a horizontal rotating cylinder. Dissert. Abstr.

N77-29439 Toledo Univ., Ohio.
MOMENTUM AND HEAT TRANSFER THROUGH LAMINAR BOUNDARY LAYERS OVER ROTATING BODIES Ph.D. Thesis
Min-Hsiun Lee 1976 126 p
Avail: Univ. Microfilms Order No. 77-9296

Merk's type series solutions and the Runge Kutta method, with an incorporated Newton Raphson iteration procedure, were used to investigate the momentum and heat transfer through laminar boundary layers over rotating bodies with uniform and nonuniform surface temperatures. Dissert. Abstr.

N77-29440 Akron Univ., Ohio.
DEVELOPMENT OF TURBULENT WALL LAYER MODELS FOR MOMENTUM AND HEAT TRANSFER IN TUBE FLOW
Chandrasekhara Rao Kakarala 1976 232 p
Avail: Univ. Microfilms Order No. 77-8644

The surface renewal and penetration concept is the basis for turbulent transport models developed for several turbulent tube flow processes characterized by dominant wall layer turbulence phenomena. The analytical models developed include: (1) unified momentum and heat transfer models that are applicable for laminar, transitional, and fully developed turbulent flow. The heat transfer model is limited to moderate Prandtl number fluids; (2) liquid metal heat transfer model based on the unified model concepts with applicability for low as well as high Peclet number flow conditions. Solutions are developed for both uniform heat flux and uniform wall temperature boundary conditions; (3) Forced convection variable property heat transfer model with emphasis on supercritical fluids and (4) combined forced and free convection heat transfer model for vertical tube flow with emphasis on supercritical fluids. Dissert. Abstr.

N77-29441 Tulsa Univ., Okla.
DRAG REDUCTION IN COCURRENT HORIZONTAL NATURAL GAS-HEXANE PIPE FLOW Ph.D. Thesis
Russell Hugh Dowling 1976 144 p
Avail: Univ. Microfilms Order No. 77-6689

The drag reduction and degradation characteristics were studied as a function of pipe diameter, gas flow rate, liquid flow rate and additive concentration for the Conoco CDR and Shell PEP-4 polymers and the Dowell APE micellar type formulation. It was found that drag reduction behavior in annular-mist flow was analogous to single-phase liquid flow: increasing friction velocity resulted in decreasing levels of drag reduction, and higher concentrations gave higher drag reductions. Furthermore, as the liquid/gas ratio increased so did the level of drag reduction: up to 34% drag reduction was observed for the Dowell APE formulation at the highest liquid rates, whereas drag increases were found for liquid/gas ratios on the order of 10 B/MMscf or less. Drag reduction in two-phase annular-mist flow, which is limited to the contribution of the liquid phase to the overall two-phase pressure drop, was shown to depend on pipe size as well as liquid/gas ratio. Dissert. Abstr.

N77-29442 Cornell Univ., Ithaca, N.Y.
AN ASYMPTOTIC APPROACH TO THE SEPARATION OF TWO-DIMENSIONAL LAMINAR BOUNDARY LAYERS Ph.D. Thesis
Joseph P. Nenni 1976 97 p
Avail: Univ. Microfilms Order No. 77-8367

The problem of laminar boundary layer separation is examined using asymptotic methods to identify some overall features of an unsteady boundary layer near a separation point. An asymptotic solution for large distances from the wall is constructed for both steady and unsteady flows. These solutions show that unmatchability can only occur if the boundary layer solution develops a singularity with respect to x for the steady case and in the x-t plane in the unsteady case. The asymptotic solution is then used in conjunction with approximate analyses for the flow near the wall. For steady flows, the unmatchability condition is shown to coincide with the customary criterion of vanishing wall shear. But the real criterion is that the shear should have a singularity, which is of the Goldstein type and happens to occur at zero shear. The same methods of analysis applied to unsteady flow suggest that singular behavior may develop in different ways. Dissert. Abstr.

N77-29443 Illinois Univ., Urbana-Champaign.
APPLICATION OF THE FINITE ELEMENT METHOD TO POTENTIAL FLOW PROBLEMS Ph.D. Thesis
Ki Dong Lee 1976 146 p
Avail: Univ. Microfilms Order No. 77-9070

An iterative finite element scheme is developed to solve potential flow problems. In this scheme, the field of computation is divided into sectors, each of which has an arbitrary number of basic elements. Computations are performed by sweeping all the sectors. This scheme benefits in data handling of the finite element computer programs for larger problems as well as in implementing non-Dirichlet boundary conditions. To study the effect of the choice of mesh systems on the computational error, a parametric study is made by applying the finite element method to potential flow problems around an elliptic cylinder. Treatment of non-Dirichlet boundary conditions is considered concerning its effect on the computational error, and computation of spatial derivatives in the finite element mesh is discussed. Dissert. Abstr.

N77-29444 Illinois Univ., Urbana-Champaign.
AN EXPERIMENTAL STUDY OF REACTIVE TURBULENT MIXING Ph.D. Thesis
Larry Philip Cooper 1976 214 p
Avail: Univ. Microfilms Order No. 77-8963

A variable temperature, variable composition study of the kinetic behavior of this system was performed utilizing a chemical kinetics computer routine. On the basis of this study and subsequent experiments it was determined that the reactant should be preheated to 1280 K to minimize deviations from true hypergolic kinetics. The six turbulence generators were found to affect the extent of conversion of the carbon monoxide and the mass fraction of center stream to different degrees. The effects can be explained on the basis of the average eddy size (integral scale) and the bulk mixing of the streams. It was found that increasing the bulk mixing and decreasing the eddy size leads to a better rate of conversion of the carbon monoxide. It was found that the complete conversion of the carbon monoxide does not require complete molecular mixing. The final molecular mixing phase is the unreactive mixing of the carbon dioxide product and excess oxygen reactant. Dissert. Abstr.

N77-29445 Purdue Univ., Lafayette, Ind.
A HEAT AND MASS TRANSFER ANALYSIS OF THIN FILMS AS APPLIED TO INFRARED HOLOGRAPHIC RECORDING Ph.D. Thesis
Frederic Anton Matekunas 1976 166 p
Avail: Univ. Microfilms Order No. 77-7490

The field of infrared holography is examined in relation to the design of a film suitable for recording and reconstructing holograms in the infrared with CO2 lasers at maximum diffraction efficiency. As a basis for the design, the two dimensional transient conduction equation is solved for the case of a thin film on a substrate exposed to spatially varying irradiation. Both opaque and semi-transparent films are considered. These solutions are examined to define resolution and sensitivity characteristics as determined by system dimensions, thermal properties, and boundary conditions. Dissert. Abstr.

N77-29446 California Univ., Los Angeles.
NATURAL CONVECTION IN HORIZONTAL FLUID LAYERS Ph.D. Thesis
Ahti Jorma Suo-Anttila 1976 153 p

Avail: Univ. Microfilms Order No. 77-7692

Thermal convection in horizontal fluid layers is considered. The experimental work consists in developing and using a thermal convection cell to obtain measurements of the heat flux and turbulent core temperature of a horizontal layer of fluid heated internally and subject to both stabilizing and destabilizing temperature differences. Power integral methods were found to be adequate for interpolating and extrapolating the data. The theoretical work consists of the derivation, solution and use of the mean field equations as applied to thermally driven convection in horizontal layers of infinite extent. The equations were derived by a separation of variables technique where the horizontal directions were described by periodic structures and the vertical being some function of z. The derivation resulted in a coupled set of momentum and two types of energy equations. The equations were simplified by using the infinite Prandtl number limit and neglecting direct intermodal interaction. Dissert. Abstr.

N77-29447 Minnesota Univ., Minneapolis.

NATURAL CONVECTION HEAT TRANSFER FROM A HORIZONTAL CIRCULAR CYLINDER TO A SURROUNDING CYLINDRICAL ENCLOSURE Ph.D. Thesis

Thomas Howard Kuehn 1976 295 p

Avail: Univ. Microfilms Order No. 77-6969

Natural convection heat transfer through fluids bounded by horizontal isothermal cylinders was studied. The overall heat transfer coefficient for the case of one cylinder located inside a cylindrical enclosure depends on Rayleigh number, Prandtl number, diameter ratio and eccentricity of the inner cylinder. The effects of eccentricity and Rayleigh number were studied experimentally. A general correlation theory has been developed to predict overall heat transfer between concentric and eccentric cylinders, heat transfer to fluids contained within a horizontal cylinder and from single horizontal cylinders. This method has been successfully extended to other geometries that have spherical or vertical boundaries. Dissert. Abstr.

N77-29448*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

INSTRUMENT CONCEPT FOR GEOPHYSICAL FLUID FLOW EXPERIMENTS ON THE FIRST SPACELAB MISSION

Richard S. Rodkin and George H. Fichtl Aug. 1977 44 p refs

(NASA-TM-78127) Avail: NTIS HC A03/MF A01 CSCL 20D

A concept is provided for a geophysical fluid flow cell (GFFC) and sufficient detail is given to allow the start of a design effort. A brief background of the scientific studies to be conducted with the GFFC and its theoretical basis for operation are also included. Author

N77-29449# Cambridge Univ. (England). Dept. of Engineering.

COMPRESSIBLE FLOW IN A CENTRIFUGAL IMPELLER WITH SEPARATION: A TWO-DIMENSIONAL CALCULATION METHOD

D. P. Sturge 1976 36 p refs

(CUED/A-Turbo/TR-82) Avail: NTIS HC A03/MF A01

A method of calculating inviscid subsonic compressible flow on the blade-to-blade surface of a centrifugal impeller is presented, in which the flow is allowed to separate from the suction side. It is assumed that there is no mixing of the flow with the separated region. An unusual feature is that the flow equations are solved by a finite difference scheme in streamline coordinates. A few results of calculations are presented, in which the effects of inclusion of different sizes of separated region are clearly seen. Author

N77-29450# Cambridge Univ. (England). Dept. of Engineering.

LINEARIZED SUPERSONIC UNSTEADY FLOW IN CASCADES

T. Nagashima and D. S. Whitehead 1976 55 p refs

(CUED/A-Turbo/TR-84) Avail: NTIS HC A04/MF A01

A linearized theory is presented for the calculation of force and moment coefficients for two-dimensional cascades of blades in supersonic flow. The cases of both supersonic and subsonic axial velocity are treated. The perturbations are due to bending vibration, torsional vibration, and wakes shed from moving obstructions upstream. The method leads to analytical results in the quasi-steady case, and to a fast computer program for the general unsteady case. Results are all in good agreement with previous work. The method can be used to predict forced vibration and flutter in transonic fan blades. Author

N77-29451*# Rockwell International Corp., Downey, Calif. Space Div.

FLEXIBLE CRYOGENIC HEAT PIPE DEVELOPMENT PROGRAM Final Report

Jul. 1976 147 p refs

(Contract NAS2-8830)

(NASA-CR-152027; SD-77-AP-0088) Avail: NTIS HC A07/MF A01 CSCL 20D

A heat pipe was designed for operation in the 100 - 200 K temperature range with maximum heat transport as a primary design goal; another designed for operation in the 15 - 100 K temperature range with maximum flexibility as a design goal. Optimum geometry and materials for the container and wicking systems were determed. The high power (100 - 200 K) heat pipe was tested with methane at 100 - 140 K, and test data indicated only partial priming with a performance limit of less than 50 percent of theoretical. A series of tests were conducted with ammonia at approximately 280 K to determine the performance under varying fluid charge and test conditions. The low temperature heat pipe was tested with oxygen at 85 - 95 K and with methanol at 295 - 315 K. Performance of the low temperature heat pipe was below theoretical predictions. Results of the completed testing are presented and possible performance limitation mechanisms are discussed. The lower-than-expected performance was felt to be due to small traces of non-condensible gases which prevented the composite wick from priming. Author

N77-29452*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

DOWNSTREAM INFLUENCE OF SWEPT SLOT INJECTION IN HYPERSONIC TURBULENT FLOW

Jerry N. Hefner, Aubrey M. Cary, Jr., and Dennis B. Bushnell Washington Aug. 1977 52 p refs

(NASA-TN-D-8506; L-11464) Avail: NTIS HC A04/MF A01 CSCL 20D

Results of an experimental and numerical investigation of tangential swept slot injection into a thick turbulent boundary layer at Mach 6 are presented. Film cooling effectiveness, skin friction, and flow structure downstream of the swept slot injection were investigated. The data were compared with that for unswept slots, and it was found that cooling effectiveness and skin friction reductions are not significantly affected by sweeping the slot. Author

N77-29453# California Univ., Livermore. Lawrence Livermore Lab.

CALCULATION OF TWO-PHASE DISPERSED DROPLET-IN-VAPOR FLOWS INCLUDING NORMAL SHOCK WAVES

W. J. Comfort, T. W. Alger, W. H. Giedt, and C. T. Crowe 28 Jul. 1976 20 p refs Presented at Ann. Meeting of the Amer. Soc. of Mech. Eng., New York, 29 Nov. 1976

(Contract W-7405-eng-48)

(UCRL-78426; Conf-761107-16) Avail: NTIS HC A02/MF A01

Quasi-one-dimensional, steady state, two phase dispersed droplet-in-vapor flow calculations have been developed. The technique is applicable to both subsonic and supersonic single component flow in which normal shock waves occur, and is the basic for a two dimensional model. The flow is assumed to be inviscid except for droplet drag. Temperature and pressure equilibrium between phases is assumed. Example calculations of flow in one dimensional nozzles with and without normal shocks are given and compared with experimentally measured pressure profiles for both low quality and high quality two-phase steam/water flow. ERA

N77-29454# Argonne National Lab., Ill. Components Technology Div.

DYNAMICS OF A CYLINDRICAL SHELL SYSTEM COUPLED BY VISCOUS FLUID

T. T. Yeh and S. S. Chen 1976 37 p refs Presented at the

92d Meeting of the Acoust. Soc. of Am., San. Diego, Calif., 16-19 Nov. 1976
(Contract W-31-109-eng-38)
(CONF-761138-2) Avail: NTIS HC A03/MF A01

The system component is modeled as two coaxial shells separated by a viscous fluid. In the analysis, Fluegge's shell equations of motion and linearized Navier-Stokes equation for viscous fluid are employed. First, a traveling wave type solution is taken for shells and fluid. Then, from the interface conditions between the shells and fluid, the solution for the fluid medium is expressed in terms of shell displacements. Finally, using the shell equations of motion gives the frequency equation, from which the natural frequency, mode shape, and modal damping ratio of coupled modes can be calculated. The analytical results show a fairly good qualitative agreement with the published experimental data. With the presented analysis and results, the frequency and damping characteristics can be analyzed and design parameters can be related to frequency and damping. ERA

N77-29455# Los Alamos Scientific Lab., N. Mex.
GAS-INTERFACE STUDIES IN LARGE HORIZONTAL HEAT PIPES
J. E. Deverall Jan. 1977 16 p
(Contract W-7405-eng-36)
(LA-6646-MS) Avail: NTIS HC A02/MF A01

A series of tests was made with a large diameter, horizontal heat pipe to study the feasibility of maintaining cool zones at the ends with inert buffer gases for metal vapor laser applications. Studies were made of the slope and stability of the gas interface with both water and mercury as the working fluids. Successful operation was achieved using a buffer gas mixture for water vapor and a convection baffle system for mercury vapor. Results indicated that there is a critical heat pipe diameter, which if exceeded requires a definite gas density to establish an effective interface, but for smaller diameters, operation was indenpendent of gas density. ERA

N77-29456# Sandia Labs., Albuquerque, N. Mex.
NATURAL CONVECTION IN POROUS MEDIA WITH HEAT GENERATION
Harry C. Hardee, Jr. and Robert H. Nilson Dec. 1976 45 p refs
(Contract E(29-1)-789)
(SAND-76-0433) Avail: NTIS HC A03/MF A01

Heat transfer characteristics of a fluid saturated porous media are investigated for the case of uniform internal heat generation with cooling from above. Analytical models of conduction and single phase cellular convection show good agreement with previous Rayleigh number correlations and with experimental data obtained by Joule heating of salt water in a sand bed. An approximate dryout criterion is also derived for two phase boiling heat transfer in a fixed bed which is neither channeled nor fluidized. Correlation of dryout data using this criterion is encouraging, especially considering the analytical rather than correlational of the criterion. ERA

N77-29457# Massachusetts Inst. of Tech., Cambridge. Dept. of Nuclear Engineering.
INVESTIGATION OF THE FRAGMENTATION OF MOLTEN METALS DROPPED IN COLD WATER
Gautam S. Shiralkar and Neil E. Todreas Nov. 1976 131 p refs
(Contract EY-76-S-02-2781)
(COO-2781-7TR) Avail: NTIS HC A07/MF A01

Experiments were conducted dropping small solid spheres at a high temperature instead of molten metal drops, and indicate a significant difference from the latter. Several hypotheses were proposed based on the hydrodynamics of the molten drop and tested analytically. The theory that the drop fragmentation is caused by the violent release of dissolved gas from within the drop was investigated experimentally and lead to the conclusion that tin fragmentation probably does not occur in this way. It is felt that a calculation of the dynamics of the vapor film that would be expected to surround the hot drop is needed. ERA

N77-29458# Sandia Labs., Albuquerque, N. Mex.
RECENT DEVELOPMENTS IN THE USE OF FINITE ELEMENT METHODS IN FLUID DYNAMICS
D. K. Gartling 1976 27 p refs Presented at the Annual Meeting of the Am. Soc. of Mech. Engr., New York, 29 Nov. 1976
(Contract E(29-1)-789)
(SAND-76-5741; Conf-761107) Avail: NTIS HC A03/MF A01

The use of the finite element method in the field of fluid mechanics has received increased attention within the last decade. Recent work in the application of the method to problems of viscous, incompressible flow is reviewed. The analysis of coupled fluid/thermal problems is also discussed. Problem formulations, solution methods and examples of typical finite element calculations are presented. Areas of current and future research and development are described. ERA

N77-29459# Politecnico di Torino (Italy). Ist. di Macchine e Motori per Aeromobili.
VOLUTE FLOW IN RADIAL FLOW CENTRIFUGAL PUMPS STUDY. THEORETICAL AND EXPERIMENTAL STUDY [MOTO NELLA VOLUTA DELLE POMPE CENTRIFUGHE E SPINTA RADIALE. INDAGINE TEORICA E SPERIMENTALE]
Matteo Andriano May 1976 24 p refs In ITALIAN; ENGLISH summary
(Contract CNR-CT-73-01739.07-115.6746)
(Publ-179) Avail: NTIS HC A02/MF A01

An analysis was made of the flow of water within the volute fed by the impeller of a centrifugal pump, without recourse to uniform pressure hypothesis, yet with one-dimensional theory. To go beyond the limits peculiar to such simplified approach, experimental tests were performed to evaluate radial thrust on the impeller and direct measurements were made of the pressure distribution in the volute casing. Information on fluid flow patterns (based on relative momentum variations) were obtained which are needed for further refinements of the theory. Author (ESA)

N77-29460# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
PREDICTION OF TURBULENT BOUNDARY LAYERS AND WAKES IN COMPRESSIBLE FLOW BY A LAG-ENTRAINMENT METHOD
J. E. Green, D. J. Weeks, and J. W. F. Brooman London Aeron. Res. Council 1977 67 p refs Supersedes RAE-TR-72231; ARC-34458
(ARC-R/M-3791; RAE-TR-72231; ARC-34458) Avail: NTIS HC A04/MF A01; HMSO £6; PHI $22.95

A rapid method is presented for predicting the development of turbulent boundary layers and wakes taking account of the influence of the upstream flow history on the turbulent stresses. The method employs the momentum integral equation, the entrainment equation, and an equation for the streamwise rate of change of entrainment coefficient. This last explicitly represents the balance between the advection, production, diffusion, and dissipation of turbulent kinetic energy. The application of the method to two-dimensional and axisymmetric flows is described, and it is shown how secondary influences on the turbulence structure, such as longitudinal surface curvature, can be logically taken into account. Comparisons with experiments show that, for incompressible flow, the method is fully comparable in accuracy with the best of the methods assessed at the Stanford Conference of 1968. For compressible flow, the accuracy of the method in flow at constant pressure is ensured by its derivation, but the available experimental data do not enable its accuracy in flows with strong pressure gradients to be assessed with any finality. Author (ESA)

N77-29461# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
PANEL FLUTTER BOUNDARY LAYER INTERACTION. A THEORETICAL STUDY
P. W. Taylor Mar. 1977 150 p refs
(Contract NPL-82/037)
(TT-7006) Avail: NTIS HC A07/MF A01

Areas in which the forces concerned with self induced flutter motion of a thin, flat panel may be affected by turbulent flow are examined. Previous theories are summarized and literature on the interaction between a fluid and a flexible panel is reviewed.

A mathematical analysis of the problem of the interaction between a panel and a fluid is presented. ESA

N77-29462# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
FORMATION AND TRANSFORMATION OF A RING VORTEX RESULTING FROM DROP IMPINGEMENT ON A LIQUID FILM [BILDUNG UND UMBILDUNG EINES RINGWIRBELS, DER DADURCH ENSTEHT, DASS EIN TROPFEN IN EINE FLUESSIGKEITSSCHICHT FAELLT]
Erich Martin Dec. 1976 104 p refs In GERMAN
(MPIS-31/1976) Avail: NTIS HC A06/MF A01; Max-Planck-Inst. fuer Stroemungsforsch., Goettingen, West Ger. DM 26.86

Results from Kutter's experiments on drops falling into liquids were confirmed and the secondary vortices generated investigated. The penetration depth of the vortex ring resulting from the drop impingement varies with the fall height of the drop. The number of secondary vortices was also investigated as a function of height. The formation of an internal crown in the liquid and its vortex rings were observed. ESA

N77-29463# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
FORMATION AND TRANSFORMATION OF A WATER BELL RESULTING FROM IMPINGEMENT OF A VERTICAL LIQUID JET ON A HORIZONTAL PLATE [BILDUNG UND UMBILDUNG EINER WASSERGLOCKE, DIE DADURCH ENTSTEHT, DASS EIN VERTIKALER FLUESSIGKEITSSTRAHL GEGEN EINE HORIZONTALE SCHEIBE STROEMT]
Christa Goedeke Dec. 1976 68 p refs In GERMAN
(MPIS-32/1976) Avail: NTIS HC A04/MF A01; Max-Planck-Inst. fuer Stroemungsforsch., Goettingen, West Ger. DM 22.20

The formation and transformation of a water bell resulting from the impingement of an axisymmetric water jet perpendicularly to a circular plate were investigated. The various bell shapes and their different behavior are described as a function of the diameters of the plate and nozzle, and the jet exhaust velocity. These shapes are observed when the distance between plate and nozzle is varied. A possible analogy with step changes for vortex jets was examined. ESA

N77-29464# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
VORTEX FORMATION AT RECTANGULAR NOZZLES AND TRANSFORMATION INTO SECONDARY VORTICES (EXPERIMENTAL INVESTIGATION) Ph.D. Thesis - Goettingen Univ., West Ger. [WIRBELBILDUNG AN RECHTECKIGEN DUESEN UND- UMBILDUNG IN SEKUNDAERWIRBEL (EXPERIMENTELLE UNTERSUCHUNG)]
Andreas Heertsch Dec. 1976 58 p refs In GERMAN
(MPIS-34/1976) Avail: NTIS HC A04/MF A01; Max-Planck-Inst. fuer Stroemungsforsch., Goettingen, West Ger. DM 15

Experiments were carried out on single vortices in water to substantiate Schneider's qualitative and quantitative phenomenology of the occurring secondary vortex processes. The transformation processes are qualitatively described for primary vortices coming out of a rectangular opening and leading to the formation of two or more secondary vortices. It is shown quantitatively that rectangular nozzle openings with a side ratio of 1:3 are sensitive to transformations for low output thrust parameters. ESA

N77-29465# Institut Franco-Allemand de Recherches, St. Louis (France).
SIMULATION OF INTERIOR BALLISTICS PHENOMENA IN GAS DYNAMIC COMPUTATION MODELS [SIMULATION INNENBALLISTISCHER VORGAENGE IN GASDYNAMISCHEN RECHENMODELLEN]
K. Hoog 9 Sep. 1976 48 p refs In GERMAN
(ISL-R-125/76) Avail: NTIS HC A03/MF A01

Several fluid mechanics problems in dealing with the interior ballistics of guns are described, and the approximation of the separate phenomena in gas dynamic models is indicated. The numerical implementation of these models is discussed. A two phase model using a finite difference method and Euler coordinates is described. The results of a test calculation using this model applied to a 20 mm cannon compare well with those obtained using a method of characteristics. ESA

N77-29466# European Space Agency, Paris (France).
PROGRESS IN THE CALCULATION OF TWO AND THREE-DIMENSIONAL TURBULENT BOUNDARY LAYERS
Jean Cousteix Jun. 1977 95 p refs Transl. into ENGLISH of 'Progr. dans les Methodes de Calcul des Couches Limites Turbulentes Bi- et Tridimensionnelles', ONERA, Paris Report ONERA-NT-1976-15, 1976 Original report in FRENCH previously announced as N77-25462
(ESA-TT-385; ONERA-NT-1976-15) Avail: NTIS HC A05/MF A01

The main types of methods for calculating turbulent flows are reviewed in the frame of their application to boundary layer prediction. Their performances are evaluated by means of comparisons with various experiments in two-dimensional flow. The use of these methods is also discussed in the case of three-dimensional boundary layers. Author (ESA)

N77-29467# Johns Hopkins Univ., Baltimore, Md.
A THEORY OF MIXING IN A STABLY STRATIFIED FLUID
Robert R. Long Mar. 1977 23 p refs
(Contract N00014-75-C-0805; Grant NSF OCE-76-18887)
(AD-A038425; TR-11-Ser-C) Avail: NTIS HC A02/MF A01 CSCL 20/4

A theory is developed for turbulence in a stably stratified fluid in which there is no shear and the turbulence is induced by a source of energy near the lower boundary of the fluid. A growing mixed layer appears in the lower portion of the fluid, separated from the non-turbulent fluid above, in which the mean buoyancy gradient is given, by an interfacial layer (IL). The lower mixed layer has a very weak buoyancy gradient but a large buoyancy difference exists across IL. If u is the rms horizontal velocity and l is the integral length scale, ul = K is a constant in a layer of homogeneous fluid agitated by a grid and at some distance from the grid. When there is stratification, the fluid motion is unaffected by buoyancy forces in the mixed layer so that ul should also be constant in the lower portions of the mixed layer. Author

N77-29468# ARO, Inc., Arnold Air Force Station, Tenn.
AN EXPERIMENTAL AND ANALYTICAL INVESTIGATION OF A TRANSONIC SHOCK-WAVE/BOUNDARY-LAYER INTERACTION Final Report, 1 Jul. 1975 - 30 Jun. 1976
M. C. Alstatt AEDC May 1977 41 p refs
(AD-A040023; ARO-PWT-TR-77-22; AEDC-TR-77-47) Avail: NTIS HC A03/MF A01 CSCL 20/4

Two wind tunnel tests were conducted in a flow exhibiting a shock-wave/boundary-layer interaction of the type occurring on airfoils at transonic velocities. Boundary-layer pressure distributions were measured with pitot and static probes. Velocities in the free stream and in the boundary layer were obtained with a laser velocimeter (LV) system, and a data reduction program for the LV results was developed. Measurements from the pressure probes and from the LV system are compared with each other and with theoretical computations. It was found that the analytic models for boundary-layer velocity profile and Reynolds stress agree well with experimental measurements. Author (GRA)

N77-29469# Pennsylvania State Univ., University Park. Applied Research Lab.
TURBULENT PRESSURE SPECTRA
W. K. George, Jr., P. D. Beuther, and R. E. A. Arndt 20 Dec. 1976 41 p refs
(Contract N00017-73-C-1418)
(AD-A036342; TM-76-310) Avail: NTIS HC A03/MF A01 CSCL 20/4

Similarity laws for the pressure spectrum in turbulent flows are developed. Comparable to the -5/3 power law for the velocity spectrum in the inertial subrange there is a -7/3 power law relationship for the pressure spectrum. Although the law wave number spectrum scales with relatively easily measured flow field properties, further measurements, especially of the turbulent dissipation are necessary to quantify the Holomogorov constant which appears in the high wave number relationship. Presently the estimates for this quantity vary between 2.25 and 5.6. Measurements of the pressure spectra in the mixing layer of an axisymmetric jet confirm the predicted scaling laws at high and low wavenumber. Author (GRA)

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N77-29470*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

OPTICAL ZERO-DIFFERENTIAL PRESSURE SWITCH AND ITS EVALUATION IN A MULTIPLE PRESSURE MEASURING SYSTEM

J. Anthony Powell Washington Aug. 1977 23 p refs
(NASA-TM-X-3571; E-9139) Avail: NTIS HC A02/MF A01 CSCL 14B

The design of a clamped-diaphragm pressure switch is described in which diaphragm motion is detected by a simple fiber-optic displacement sensor. The switch was evaluated in a pressure measurement system where it detected the zero crossing of the differential pressure between a static test pressure and a tank pressure that was periodically ramped from near zero to fullscale gage pressure. With a ramping frequency of 1 hertz and a full-scale tank pressure of 69 N/sq cm gage (100 psig), the switch delay was as long as 2 milliseconds. Pressure measurement accuracies were 0.25 to 0.75 percent of full scale. Factors affecting switch performance are also discussed. Author

N77-29471*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.

LOW INTENSITY X-RAY AND GAMMA-RAY IMAGING DEVICE Patent Application

Lo I. Yin, inventor (to NASA) Filed 20 Jul. 1977 20 p
(NASA-Case-GSC-12263-1; US-Patent-Appl-SN-817415) Avail: NTIS HC A02/MF A01 CSCL 14B

A radiation to visible light converter is combined with a visible light intensifier. The converter is a phosphor or scintillator material, modified to block ambient light. The intensifier includes fiber optics input and output face plates with a photocathode microchannel plate amplifier-phosphor combination. Incoming radiation is converted to visible light by the converter which is piped into the intensifier by the input fiber optics face plate. The photocathode converts the visible light to electrons which are amplified by a microchannel plate amplifier. The electrons are converted back to light by a phosphor layer and piped out for viewing by the output fiber optics face plate. The converter-intensifier combination may be further combined with it's own radiation source or used with an independent source. NASA

N77-29472# Texas Univ., Austin. Applied Research Labs.

DEVELOPMENT AND USE OF A SCHLIEREN SYSTEM FOR SOUND PULSE STUDIES Interim Report

David R. Kleeman Aug. 1976 136 p refs
(Contracts F44620-76-C-0040; F44620-71-C-0015; N00014-70-A-0166; N00014-75-C-0867; AF Proj. 2307)
(AD-A040010; ARL-TR-76-43; AFOSR-77-0679TR) Avail: NTIS HC A07/MF A01 CSCL 14/5

Herein is described the schlieren photographic method, in which a density disturbance, such as an acoustic N wave, refracts light passing through it in such a manner that an optical image of the disturbance can be formed on a piece of film. The presentation of the method includes a theoretical description which relies on both geometrical and physical optics. Design considerations and the details of putting a system into operation are also given. The results of two investigations using the schlieren method are presented. Propagation of an acoustic pulse in a duct is modeled, and the photographs are compared with a geometrical prediction based on the method of images. The focusing of a spherical N wave is also photographed. GRA

N77-29473# Oxford Univ. (England). Dept. of Engineering Science.

HIGHER STRAIN RATE TEST OF A LOW CARBON STEEL TO HIGH STRAINS OVER A RANGE OF TEMPERATURES, USING A TORSIONAL HOPKINSON-BAR APPARATUS

M. G. Stevenson and J. D. Campbell Sep. 1974 43 p refs Sponsored in part by Brit. Council and Univ. of New South Wales
(Grant AF-AFOSR-71-2056)
(OUEL-1098/74) Avail: NTIS

A recent version of a torsional Hopkinson bar apparatus, capable of high strains such as found in metal working, is briefly described. The magnitude of axial forces and bending waves in the system during a test was determined and their effects on measured flow stress shown to be negligible. Adaptions to the system to permit elevated temperature testing are described. Test results for a low carbon free-machining steel are given for shear strain rates up to 4330/s and temperatures up to 500 C. In all but one case this material fractured in the dynamic tests before the potential strain was realized, but shear strains of about 1.3 were usually obtained. Because of the large strains, adiabatic heating during the dynamic tests had a substantial effect on the stress-strain curves. The dynamic strain ageing effect was clearly evident from the tests at 400 and 500 C. Author (ESA)

N77-29474# Institut Franco-Allemand de Recherches, St. Louis (France).

SPECIAL ARRANGEMENTS FOR MICROPARTICLE HOLOGRAPHY [MONTAGES PARTICULIERS POUR L'HOLOGRAPHIE DES MICROPARTICULES]

H. Royer 11 Jun. 1976 33 p refs In FRENCH
(ISL-R-118/76) Avail: NTIS HC A03/MF A01

Various arrangements were set up based on the Gabor arrangement. Several possibilities in the field of velocity measurement were thus obtained: particles with diameter less than the optical system resolution (5 micron), measurements with backscattering, and holography with a large number of pulses (more than 4). Results obtained by these three modes of operation are positive. ESA

N77-29475# Istituto Elettrotecnico Nazionale (Galileo Ferraris), Turin (Italy).

ANALOG TO DIGITAL CONVERSION CIRCUIT FOR MONOCHROMATIC AND TWO-COLOR PYROMETERS [CIRCUITO DI CONVERSIONE ANALOGICO-NUMERICA PER PIROMETRI MONOCROMATICI E BICOLORE]

Mario Pasta and Paolo Soardo Apr. 1975 36 p refs In ITALIAN
(IENGF-RT-251) Avail: NTIS HC A03/MF A01

An analog to digital converter for pyrometers is described, and its characteristics as well as those of the electronic components used, are discussed. There is no particular precision requirement for the components, only a stability requirement. The calibration method applicable to this type of circuit requires no electronic auxiliary instruments but three filament lamps at known temperature. ESA

N77-29476# National Physical Lab., Teddington (England). Div. of Quantum Metrology.

POLYNOMIAL REPRESENTATIONS OF STANDARD THERMOCOUPLE REFERENCE TABLES

P. B. Coates and A. C. K. Smith Mar. 1977 22 p refs
(NPL-QU-36) Avail: NTIS HC A02/MF A01

The characteristics of the standard thermocouple types are summarized in internationally accepted reference tables. Functional representations of the tables, in the form of finite power series of varying lengths, are published with them. However, the number and length of the coefficients given render them unsuitable if only a small calculator or computer is available. Truncated coefficients, and the coefficients of the equivalent Chebyschev polynomial representation, are given to help overcome this problem. Author (ESA)

N77-29477# General Electric Co., Pleasanton, Calif. Vallecitos Nuclear Center.

ADVANCED MASS SPECTROMETER Final Report, 17 Jan. 1972 - 31 Oct. 1976

Fred Halliday and John D. Stein 17 Jan. 1977 106 p
(Contract F33657-72-C-0484; ARPA Order 1702)
(AD-A038409; NEDG-12045-245) Avail: NTIS HC A06/MF A01 CSCL 14/2

The Advanced Mass Spectrometer (AMS) is a state-of-the-art

ion microprobe with fine primary ion beam focus and a unique mass spectrometer. A variable inhomogeneity magnet system, with 288 detectors, all serviced by computer data handling, provides the heart of an instrument which can monitor from mass 17 to 304 amu simultaneously. The AMS has been integrated and has undergone acceptance tests which delineate the instrument's initial operating parameters. Author (GRA)

N77-29478# Florida Univ., Gainesville. Dept. of Physics.
A SPHERICAL PLATE ELECTROSTATIC ENERGY ANALYZER
Jose M. Perez and T. L. Bailey Feb. 1977 54 p refs
(Contract N00014-76-C-0127)
(AD-A039860; TR-13) Avail: NTIS HC A04/MF A01 CSCL 20/8

A kinetic energy analyzer, to be used in proposed experimental studies of ion-atom and ion-molecule collision phenomena, has been designed and constructed. This instrument is of the electrostatic, 180 degree deflection type, and has hemispherical electrodes with radii of curvature of 1.400 and 1.600 inches respectively. The entrance and exit defining slits are identical circular apertures, 0.020 inches in diameter, spaced 3.000 inches apart. This configuration gives a nominal kinetic resolution of + or - 0.01E sub o, where E sub o is the mean kinetic energy of ions entering the analyzer. The device is designed to operate with E sub o greater than or equal to 5 eV, thus giving an optimum k.e. bandwidth for transmitted ions of Delta E sub 0 + or - 0.05 eV. First-order aberrations, and the effects of fringing E fields in the vicinity of the defining apertures, have been taken into account quantitatively in the analyzer design. One of the most important applications of the analyzer will be the measurements of K.E. spectra of energetic ions produced in 25-5000 eV collisions. For high resolution measurements (at E sub o approx 5 eV., giving Delta E sub o approx 0.05 eV.), it is thus necessary to retard the fast ions leaving the collision region by a factor varying from about 5:1 to 1000:1. A relatively simple cylindrically-symmetric electrostatic lens system has been designed for this purpose. The rather extensive calculations necessary for this design were carried out by means of a computer program, based on paraxial ray electron-ion optics. Author (GRA)

N77-29479# Harris Corp., Melbourne, Fla. Electronic Systems Div.
WIDEBAND HOLOGRAPHIC DIGITAL RECORDING AND REPRODUCTION Final Technical Report, Jan. 1973 - Nov. 1976
Andrew M. Bardos, George S. Moore, Richard H. Nelson, Lynda M. Ralston, and Michael W. Shareck Apr. 1977 371 p refs
(Contract F30602-73-C-0155; ARPA Order 2322)
(AD-A040079; RADC-TR-77-153) Avail: NTIS HC A16/MF A01 CSCL 14/3

Techniques were investigated to apply the concept of holography to the problems of wideband digital recording and reproduction. The feasibility of recording at rates up to 2 Gb/s and playback at both full-record and reduced speeds was theoretically and experimentally considered. The program was a multi-phased effort including the design, development and experimental evaluation of two Exploratory Development Models (EDMs): the Phase I EDM demonstrated recording at 400 Mb/s and playback at 40 Mb/s, and was used to guide design trade-offs for Phase II; the Phase II EDM demonstrated recording at 600 Mb/s playback at full-record and 0 to 1 time expanded rates with bit-error-rates better than 1/1,000,000. Both full-system operational testing and parametric evaluation on a component basis were performed. This report describes design and performance data at both the system and the subsystem levels for the Phase II hardware. Also a part of this program was the development of conceptual designs for portential multi-gigabit recorders. These designs are presented, along with system and subsystem level trade-offs between the various concepts, and recommendations for subsequent development. GRA

N77-29480# National Bureau of Standards, Boulder, Colo. Electromagnetics Div.
DEVELOPMENT OF AN RF NEAR-FIELD EXPOSURE SYNTHESIZER (10 TO 40 MHz)
Frank M. Greene 1977 41 p refs
(PB-266442/3; DHEW/PUB/NIOSH-76/160; NIOSH-76-160)
Avail: NTIS HC A03/MF A01 CSCL 06R

The design, construction, installation, and testing of a prototype radiofrequency near field synthesizer are described. These fields are to be used in various ratios for the evaluation of occupational hazards resulting from exposure of industrial personnel to strong, non-ionizing, RF radiation. The synthesizer consists of a balanced, parallel plate strip line to generate the desired electric field, and a single turn quadruple feed inductor to generate the desired magnetic field. The electric field and magnetic field components can be adjusted independently to simulate various near field configurations. GRA

N77-29481# Lincoln Lab., Mass. Inst. of Tech., Lexington.
REAL TIME DIGITAL RECORDING OF THERMOVISION DATA
Ronald J. Cordova and Ronald R. Parenti 2 Mar. 1977 32 p
(Contract F19628-76-C-0002; ARPA Order 2752)
(AD-A040134; TT-18; ESD-TR-77-56) Avail: NTIS HC A03/MF A01 CSCL 14/3

A direct, real time, video to digital data recording system has been developed to record 10 micrometers thermal imagery in conjunction with an AGA 680 LW camera. This device is now being used to study the thermal characteristics of various types of natural terrain for the purpose of developing tactical target acquisition techniques. This data recording system consists of an analog to digital interface, NOVA 2/10 minicomputer, and magnetic tape transport and is designed to record 16 frames per second at a 175 kHz instantaneous digitization rate with 8 bit precision. Computer controlled timing circuits group pairs of 8 bit data words into a single 16 bit NOVA compatible word in an intermediate buffer which is then transferred into core memory. The minicomputer stores complete frames of data during the active camera scan period while simultaneously maintaining a constant 88,000 word/second transfer rate to the 9 track magnetic tape unit. The final data format consists of a 74 X 74 picture element array with 0.2 C temperature resolution and 50 C dynamic range. Author (GRA)

36 LASERS AND MASERS

Includes parametric amplifiers.

N77-29482 California Univ., Los Angeles.
LASER PUMPED LASERS FOR ISOTOPE SEPARATION Ph.D. Thesis
Stephen Moss Fry 1976 363 p
Avail: Univ. Microfilms Order No. 77-8512

A study of the isotope separation laser requirements reveals that high pressure polyatomic molecular gas laser pumped lasers can attain the necessary characteristics including tunability, energy output, pulse width, and repetition rate. The results of a search, made for molecules meeting the appropriate requirements for one of several pump schemes utilizing a CO2 laser and with output in the 12 mu m or 16 mu m wavelength range, are presented. Several methods of pumping are reviewed and two novel pump schemes are presented. A laser pumped laser device design is given, and operation of this device and associated diagnostic equipment is confirmed by repeating experiments in OCS and NH3. The results of OCS laser experiments show that an improvement in pump rate and output per unit length is obtained with the device, using a wedged transverse pumping scheme. Dissert. Abstr.

N77-29483 Purdue Univ., Lafayette, Ind.
MODULATION OF ACOUSTOELECTRIC DOMAINS BY INTENSE 1.06 MICRON LASER EXCITATION OF ELECTRONS IN GaAs Ph.D. Thesis
George K. Celler 1976 214 p
Avail: Univ. Microfilms Order No. 77-7427

Interaction of intense light of a Q-switched Nd:YAG laser with acoustoelectric domains in semiconducting n-GaAs was investigated. A model is presented, based on small-signal acoustoelectric theory, which explains qualitatively all the diverse modulation effects in terms of the increased electron concentration. According to this model, the modulation of current and phonon

intensity is caused primarily by two factors: the change in the electron drift velocity in the domain which affects the acoustic gain, and the change in the screening of the piezoelectric field which shifts the spectrum of the acoustoelectric interaction to higher phonon frequency. A direct application of the interaction of the laser light with the amplified acoustic flux was found. A narrow beam of light can probe the acoustic intensity in the sample and reveal it through a photoconductive response. This permits a scan of the spatial distribution and propagation of the amplified phonons. Conversely, a narrow propagating domain can be used to reveal an optical image projected onto the sample. Dissert. Abstr.

N77-29484 Illinois Univ., Urbana-Champaign.
STUDY OF MOLECULAR NITROGEN, HELIUM-XENON, ARGON-XENON INFRARED LASER SYSTEMS EXCITED BY AN ELECTRON BEAM INITIATED GAS DISCHARGE
Leon Allen Newman 1976 230 p
Avail: Univ. Microfilms Order No. 77-9119

In the case of molecular nitrogen (N2), laser action occurred mainly on the first positive system at 1.04 mu m. Pressures of up to 200 Torr were used resulting in a maximum output of 30 kW, 2 mJ pulses at an efficiency of 0.01%. Details of the kinetic model used to predict the operation of the N2 laser system are also presented. Results of the model are compared to the experiment. Conclusions are then drawn concerning the operation of this laser system. In the case of the He-Xe and Ar-Xe systems, laser action on neutral Xe transitions has been achieved at 1 atmosphere pressure. A number of near-infrared lines oscillated in both mixtures with the strongest at 1.73 mu m in Ar-Xe. Overall conversion of 0.2% in He-Xe and 1% in Ar-Xe were obtained with resulting output powers of 100-200 kW. Dissert. Abstr.

N77-29485# Lockheed Missiles and Space Co., Sunnyvale, Calif.
EYE-SAFE TRAINING SENSOR Final Technical Report
Mar. 1977 33 p
(Contract DAAK70-76-C-0256)
(AD-A040146; LMSC-D461196) Avail: NTIS HC A03/MF A01 CSCL 06/18

High-power, Class 4 lasers are utilized on the Aquila mini-RPV program to accomplish target location, artillery adjustments, and laser target designation. Lasers are classified by their capability of injuring personnel. Class 4 laser radiation is hazardous to the eye from direct beam viewing, and from specular and diffused reflections. The nominally-calculated Ocular Hazard Range for the Aquila YAG laser is 20 Km. This is only nominal, as the use of optical viewing instruments, within the beam, will extend this hazard distance considerably. Also, because of atmospheric effects upon the beam, calculation of a single Hazard Range for safety purposes is not feasible. LMSC proposed to design and build an eye-safe, Class 1, low-power, GaAs ranging laser. This laser would be compatible with the Aquila Phase 3, 4/5 sensor platforms and could be directly substituted for the high power YAG laser on the Phase 4/5 sensor platform. The eye-safe laser ranging unit proposed by LMSC, when used with a ground located cooperative retroreflective target, would provide the Army with an excellent training simulator for RPV laser operations. GRA

N77-29486# Sandia Labs., Albuquerque, N. Mex. Dept. of Laser Physics Research.
DEVELOPMENT OF A PULSE-PER-SECOND KrF LASER
A. Kay Hays, James M. Hoffman, and Gary C. Tisone Nov. 1976 16 p ref
(Contract EY-76-C-04-0789)
(SAND-76-0422) Avail: NTIS HC A02/MF A01

A 0.5 joule/pulse KrF laser (2484 A) operating at a pulse-per second was designed and constructed. A peak power of 10 to the seventh power watts and an average power of 0.5 watts were obtained. The divergence was 10 mR using stable optics and 1 mR using off-axis unstable optics. ERA

N77-29487# California Univ., Livermore. Lawrence Livermore Lab.
LASER-GENERATED STRESS PULSES FOR MATERIAL-RESPONSE STUDIES
David S. Wood (Calif. Inst. of Technol., Pasadena) and William W. Wilcox 7 Sep. 1976 23 p refs
(Contract W-7405-eng-48)
(UCID-17258) Avail: NTIS HC A02/MF A01

Experimental techniques for the generation of stress pulses of submicrosecond duration, in the form of uniaxial strain waves, were developed by absorbing the radiation from a Q-switched laser in thin films of liquids and solids resting on hard steel substrates. The experiments employed pulses of radiation at a wavelength of 1.06 m u m, with a duration of about 30 ns at half maximum power and fluences from 8 to 13 J square cm. The stress waves produced in the steel substrates were measured by means of x-cut quartz piezoelectric gages. The typical stress pulse consisted of a rapid rise to a peak value followed by a slower delay over a period of about one-quarter microsecond. The maximum stress generated with a liquid absorber was 3.4 kbar when a solution of cupric chloride in water was irradiated with a fluence of 8 J square cm. A peak stress of 15 kbar was obtained with a 1-mu m layer of aluminum under glass and a fluence of 8 J square cm. ERA

N77-29488# Institut Franco-Allemand de Recherches, St. Louis (France).
MEASUREMENT OF THE AMPLIFICATION COEFFICIENT IN A GAS FLOW (CO2-N2-He MIXTURE), EXERTED BY ELECTRIC DISCHARGE, USING TWO CO2-LASER SONDES. DETERMINATION OF ROTATION AND VIBRATION TEMPERATURES, AND THE VIBRATIONAL ENERGY IN THE MEDIUM WITH POPULATION INVERSION Ph.D. Thesis - Conservatoire Natl. des Arts et Metiers [MESURE DU COEFFICIENT D'AMPLIFICATION DANS UN ECOULEMENT GAZEUX (MELANGE CO2-N2-He), EXCITE PAR DECHARGE ELECTRIQUE, A L'AIDE DE DEUX LASERS SONDES CO2. DETERMINATION DES TEMPERATURES DE ROTATION ET DE VIBRATION, ET DE L'ENERGIE VIBRATIONNELLE DANS LE MILIEU EN INVERSION DE POPULATION]
Andre Sontag 24 Aug. 1976 76 p refs In FRENCH
(ISL-R-124/76) Avail: NTIS HC A05/MF A01

The characteristics of an electric discharge producing a population inversion in a supersonic CO2-N2-He gas flow were investigated. The amplification coefficient of the CO2 molecule vibrational transition was determined from two different rotation lines. The rotation and vibration temperature, the vibrational energy, and the efficiency of local electric energy conversion into vibrational energy in the excited medium were measured. The electric discharge in a gas flow was simulated by computer. Good agreement between computer model and test results was obtained for an overall conversion efficiency of between 0.5 and 0.6. ESA

N77-29489# Zeiss (Carl), Oberkochen (West Germany).
RESEARCH AND DEVELOPMENT OF DYE LASERS Final Report
Werner Schmidt, Willibald Appt, Adolf F. Fercher, Helmut Gerlach, Juergen Kuhl, Dieter Preussler, Helmut Scharf, Albrecht Vogel, and Norbert Wittekindt Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1976 61 p refs In GERMAN; ENGLISH summary
(Contract BMFT-NT-61)
(BMFT-FB-T-76-75) Avail: NTIS HC A04/MF A01; ZLDI, Munich DM 12,85

The development and testing of dye lasers with narrowband emission and tunable wavelength is reported. The main results are repetitively pulsed flashlamp-pumped dye lasers capable of output powers from 20 to 200 kW in the spectral range between 430 and 760 nm. Their emission lines are spectrally narrowed to less than 0.002 nm and tuned by low-loss interference filters and Fabry-Perot etalons. CW-dye lasers were also developed and the feasibility of pumping a CW-dye laser by incoherent sources was studied. The lasers proved to be highly useful instruments in spectroscopic and holographic applications and efficient pumping sources for frequency conversion by nonlinear effects. Author (ESA)

N77-29490# Institut Franco-Allemand de Recherches, St. Louis (France).
REVIEW ON HIGH SPEED APPLICATIONS OF LASER ANEMOMETRY IN FRANCE AND GERMANY
H. J. Pfeifer 31 May 1976 35 p refs Presented at the AGARD Meeting on Appl. of Non-intrusive Instr. in Fluid Flow Res., Saint-Louis, France, 3-5 May 1976

(ISL-CO-204/76) Avail: NTIS HC A03/MF A01

The development and use of laser anemometry in various French and German high-speed wind tunnels are dealt with. In all these studies the fringe type anemometer was used exclusively because it is insensitive to vibrations and high sound levels. Moreover, this type of anemometer is supposed to give the most accurate results with respect to mean flow velocity and turbulence intensity. This is especially true if electronic counters are used as data acquisition systems. Both the optical arrangements and electronic designs are described in detail. All the investigations described here relied on the natural dust particles present in the flow as velocity indicators. As a result of binational cooperation it is shown that in the wind tunnels considered the size distribution of dust particles fulfils almost completely the requirements of negligible particles lag. With some applications in high speed tunnel testing it was proved that laser anemometry is a standard measuring procedure now, and that it yields results which may not be obtained by other methods. Author (ESA)

N77-29491# Institut Franco-Allemand de Recherches, St. Louis (France).

EFFECTS OF HIGH POWER CO2-LASER PULSES ON MATTER Final Report [EINWIRKUNG LEISTUNGS-STARKER CO2-LASERIMPULSE AUF MATERIE]

M. Hugenschmidt, K. Vollrath, and W Baca 29 Sep. 1976 36 p refs In GERMAN

(Contract T/RF-31/RF-310/51140)

(ISL-R-129/76) Avail: NTIS HC A03/MF A01

Theoretical models are described governing conversion of coherent radiation energy into thermal or mechanical energy during irradiation of a material surface. The physical effects at the surface are heating, ablation, ebullition, and explosive vaporization, as well as the formation of a plasma. Experiments were conducted using a pulsed CO2 laser at energies of 10 to 30 J. The behavior of various materials (metals and dielectrics) was studied as a function of the power density in a range between 1MW/sq cm and 1 GW/sq cm. The thermodynamic data of the plasma generated was determined from optical measurements of plasma expansion based on a one-dimensional model. ESA

N77-29492# American Univ., Washington, D.C.

LASER LIGHT SCATTERING STUDIES OF FLUIDS Final Report, Oct. 1973 - Sep. 1976

John A. White Mar. 1977 23 p

(Contract N00014-68-A-0245-0008; N00014-75-C-0737)

(AD-A038855; FR-1) Avail: NTIS HC A02/MF A01 CSCL 20/5

The object of this work was to use the methods of elastic and inelastic light scattering to study critical point fluctuations and to carry through theoretical analysis to embrace the new experimental results in an improved theory of critical point phenomena. A principal focus of the present work was to study the fluctuations in a field. To this end, a contour of constant scattered intensity was measured near the critical point and the results were related to scaling law, parametric model descriptions of the critical region. GRA

N77-29493# Massachusetts Inst. of Tech., Cambridge. Francis Bitter National Magnet Lab.

DEVELOPMENT OF HIGH-POWER TUNABLE SOURCES IN THE 12 MICROMETERS AND 16 MICROMETERS REGIONS Final Technical Report

Benjamin Lax Jul. 1976 28 p

(Contract N00014-75-C-0558)

(AD-A038107) Avail: NTIS HC A03/MF A01 CSCL 20/6

Contents: Generation of 12 micrometers Radiation by Difference-Frequency Mixing of CO2 Laser Radiation in GaAs; High Power Far Infrared Generation in GaAs; Noncollinear Phase-Matched Four Photon Generation of CO2 Laser Radiation in Germanium; and Efficient High-Power 8.62 micrometers Infrared Radiation Source for Uranium Isotope Separation in UF6. GRA

N77-29494# Illinois Univ., Urbana-Champaign. Dept. of Electrical Engineering.

FREQUENCY TUNABLE LASER SOURCES Interim Report, 2 Jan. 1976 - 31 Jan. 1977

Paul D. Coleman 21 Mar. 1977 107 p refs

(Grant AF-AFOSR-2988)

(AD-A038518; UILU-ENG-77-2548; AFOSR-77-0379TR) Avail: NTIS HC A06/MF A01 CSCL 20/5

This report describes research on (1) optically pumped NH3 and PH3 with particular attention given to the 12.08 and 11.46 micrometer lines, (2) four-wave four-level nonlinear molecular systems, and (3) laser line assignments in the important far IR CH3OH laser. Author (GRA)

N77-29495# Naval Research Lab., Washington, D. C.

THE LINEAR AND SELF CONSISTENT NONLINEAR THEORY OF THE ELECTRON CYCLOTRON MASER INSTABILITY Interim Report

P. Sprangle and A. T. Drobot (Science Applications, McLean, Va.) Mar. 1977 79 p refs

(AD-A038553; NRL-MR-3474) Avail: NTIS HC A05/MF A01 CSCL 20/5

In this paper the linear and nonlinear theory of the electron cyclotron maser instability is considered. The configuration used to study the maser instability consists of relativistic electrons gyrating about and drifting along a uniform magnetic field within a parallel plate waveguide. Relativistic effects associated with the gyrating electrons are responsible for excitation of the transverse electric mode in the waveguide. Linear theory shows that the growth rate maximizes when the actual beam velocity coincides with the axial wave group velocity of the excited electromagnetic wave. This allows the performance of nonlinear analysis in a frame where both the axial wave number and axial beam velocity vanish. The nonlinear analysis shows that there are two possible mechanisms for the saturation of the unstable wave: (1) depletion of the available free energy associated with the rotating particles; (2) phase trapping of the gyrating electrons in the wave. The initial beam parameters determine which of the two mechanisms is responsible for saturation. Competition between the two saturation mechanisms leads to a peaking in the energy conversion efficiency as a function of beam energy. Numerical results of the nonlinear formalism show that energy conversion efficiencies from the particles to the wave can be as high as 60 percent in the beam frame. GRA

N77-29496# Rome Air Development Center, Griffiss AFB, N.Y.

LASER CHARACTERISTICS OF OPTICALLY PUMPED GAS PHASE MOLECULAR BROMINE

Francis J. Wodarczyk and Howard R. Schlossberg Jan. 1977 28 p refs

(AD-A038464; RADC-TR-77-50) Avail: NTIS HC A03/MF A01 CSCL 20/5

Molecular bromine has been observed to lase when optically pumped on individual vibration-rotation lines. With no dispersive elements in the cavity, the output consists of several doublets, corresponding to P- and R-branch transitions from the excited state populated by the pump pulse to various vibrational levels of the ground state. The insertion of an intracavity prism causes a single doublet to lase, with a corresponding reduction in output power. In the current experiments the output wavelength was tunable from 550 nm in the green to 750 nm in the near infrared for each transition pumped near 532 nm. The broad-band efficiency was a few tenths of a percent, with the single-line output efficiency one tenth of that. A gain of 0.04 - 0.16 per cm at 6.8 torr and 300 K was estimated. This system offers a quasicontinuous tunable source of radiation ranging from the visible to the near infrared. Author (GRA)

N77-29497# Air Force Weapons Lab., Kirtland AFB, N.Mex.

IMPROVED SURFACE DAMAGE BY RADIO-FREQUENCY SPUTTERED OVERCOATING Final Report

Jerry R. Bettis Mar. 1977 35 p refs

(AD-A038358; AFWL-TR-76-58) Avail: NTIS HC A03/MF A01 CSCL 20/5

Ten dielectric materials were deposited in half-wavelength optically thick films on dielectric substrate with varying surface roughness. The films were subjected to damaging radiation from a TEM mode ND(+3) in glass laser operating at 1.06 micrometers. The threshold optical field for damage was determined for each film. It was demonstrated that substrate roughness was

an overriding consideration in the thin-film thresholds and that no masking of defects by the film was exhibited. Author (GRA)

N77-29498# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.
TUNABLE LASERS Final Report, 1 Jul. 1974 - 30 Jun. 1976
Forbes C. Dewey, Jr. and Lon O. Hocker 28 Mar. 1977 13 p refs
(Contracts N00014-76-C-0431; N00014-67-A-0204-0092)
(AD-A038089) Avail: NTIS HC A02/MF A01 CSCL 20/5

The objectives of this research program were to develop wave-length-tunable laser systems and to explore their applications. During the program, we completed our investigation of KB5O8.4H2O and NH4B5O8.4H2O as phase-matchable nonlinear crystals for frequency doubling to 217 nm. We demonstrated further the utility and potential of rotationally-twinned 43 m nonlinear crystals by frequency-doubling a tunable dye laser in ZnSe. An enhancement of 1500 above that obtained in a single crystal was obtained. Further calculations on optimum crystallographic orientatins for nonlinear effects in twinned crystals were completed. GRA

N77-29499# Mathematical Sciences Northwest, Inc., Bellevue, Wash.
KINETIC STUDIES FOR XeF AND KrF LASERS Quarterly Interim Technical Report
R. E. Center and C. H. Fisher 1 Feb. 1977 7 p
(Contract N00014-76-C-1066; DARPA Order 1806)
(AD-A038083; QITR-1) Avail: NTIS HC A02/MF A01 CSCL 20/5

The goal of this program is to measure both the radiative lifetime and the collisional quenching rate coefficients for the XeF and KrF^* upper laser levels. Our approach is to excite a fraction of the ground state molecules in a cell using a short-pulse XeF or KrF laser. The ground state molecules will be prepared by flash dissociating a mixture of F2 and either Xe or Kr plus a monatomic diluent and then allowing the molecular XeF to come to equilibrium with the free atom densities. GRA

N77-29500# Northrop Research and Technology Center, Hawthorne, Calif. Advanced Laser Research Lab.
HIGH POWER UV LASER PUMPED DYE LASER TESTS Final Report, 28 Jun. 1976 - 31 Jan. 1977
E. A. Stappaerts Mar. 1977 35 p refs
(Contract N00014-76-C-0994)
(AD-A038119; NRTC-77-12R) Avail: NTIS HC A03/MF A01 CSCL 20/5

Photochemical stability of ten different dyes emitting in the blue-green spectral region was investigated, both for KrF and XeF laser pumping, to determine the possibility of developing high power, UV laser pumped dye lasers. Several dyes were found to exhibit better stability under UV laser pumping in comparison to flash lamp pumping. Some possible explanations are suggested. Author (GRA)

N77-29501# Illinois Univ., Urbana-Champaign. Coordinated Science Lab.
TWO DIMENSIONAL ANALYSIS OF THE GaAs DOUBLE HETERO STRIPE-GEOMETRY LASER
Leon Grun Dec. 1976 48 p refs
(Contract DAAB07-72-C-0259)
(AD-A038267; R-750; UILU-ENG-76-2238) Avail: NTIS HC A03/MF A01 CSCL 20/5

The GaIAs/GaAs stripe-geometry laser is analyzed using a recently developed technique called the effective dielectric constant (EDC) method. Unlike previously reported techniques, the EDC method allows both vertical and horizontal directions in the cross section of the laser to be taken into account in analyzing the field confinement mechanism. Computed data on field concentration and cutoff behavior of the fundamental mode are present. Author (GRA)

N77-29502# Aeronautical Research Associates of Princeton, Inc., N. J.
MODELING OF TURBULENT MIXING AND REACTIONS IN CHEMICAL LASERS Final Report, 1 Oct. 1974 - 30 Nov. 1976
Ashok K. Varma, E. Stokes Fishburne, and Robert A. Beddini Jan. 1977 88 p refs
(Contract F44620-75-C-0026)
(AD-A039010; AFOSR-77-0584TR) Avail: NTIS HC A05/MF A01 CSCL 20/5

A complete second-order closure program for the investigation of compressible, turbulent, reacting shear layers has been developed. The equations for the means and the second-order correlations are derived from the time-averaged Navier-Stokes equations. The equations contain third- and higher-order correlations, which have to be modeled in terms of the lower-order correlations. The program uses fluid mechanical turbulence models developed over the last two decades. GRA

N77-29503# Arizona Univ., Tucson. Optical Sciences Center.
UNSTABLE RESONATOR THEORY Final Report
M. O. Scully, G. T. Moore, and R. J. McCarthy Kirtland AFB, N. Mex. AFWL Mar. 1977 95 p refs
(Contract F29601-75-C-0088)
(AD-A038820; AFWL-TR-76-167) Avail: NTIS HC A05/MF A01 CSCL 20/5

This report on research on unstable resonator theory consists of three parts. Section I gives an overview of the work. In Section II a simple model is described for estimating the intensity distributions inside and emerging from lasers with high-Fresnel-number unstable resonators. In Section III modes of strip confocal unstable resonators containing spatially dependent gain are determined by means of a theory that is practical even at large Fresnel numbers. Author (GRA)

N77-29504# Texas Instruments, Inc., Dallas. Central Research Labs.
MONOLITHIC LASER Annual Technical Report, 1 May 1975 - 31 Jan. 1977
Kenneth L. Lawley, D. W. Bellavance, and J. C. Campbell Mar. 1977 69 p refs
(Contract N00014-73-C-0288)
(AD-A038792; TI-08-77-12; ATR-3) Avail: NTIS HC A05/MF A01 CSCL 20/5

This report describes the accomplishments of the third phase of the research program carried out under Contract No. N00014-73-C-0288 to develop the first prototype integrated optical transmitter. A new monolithic laser structure called an I-bar mesa laser was demonstrated. This double heterojunction GaAs/GaAlAs laser was grown by selective liquid phase epitaxy. The best devices operated at 525 mA drive current with a pulsed, 300 K threshold current density of 7.5 kA/sq cm. Methods of fabricating these devices are discussed. Also, various types of grown waveguides including bends and Y's were demonstrated. For bends, a3 dB signal attenuation is observed at a radius of curvature of approximately 1.3 mm (50 mils). This radius appears to be a practical lower limit for integrated optical circuit waveguides. The I-bar mesas were combined on a chip with a grown three-layer waveguide. Measured intensity of light transmitted by end-firing from the laser through the curved waveguide was 35% of the laser emission with a narrowband output. Also, etched double heterojunction mesa laser structures were fabricated on underlying waveguides. The emission from these lasers was evanescently coupled to this guide. A coupling of 25% of the laser emission to the guide was observed. Author (GRA)

N77-29505# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
THE EFFECT OF TURBULENCE ON LASER BEAM QUALITY Final Report, Mar. 1973 - Aug. 1976
Richard B. Rivir Nov. 1976 222 p refs
(AD-A038667; AFAPL-TR-76-94) Avail: NTIS HC A10/MF A01 CSCL 20/5

Helium Neon and Helium Cadmium Laser Beams were propagated through a turbulent medmium and the Mean Laser Beam Intensity and Power Profiles were measured in the Focal Plane. The parameter's effect of ranges of the ratios of integral and micro scales of turbulence to laser beam diameter and ranges of turbulence intensities which are typical of laser cavities are reported. The experimental measurements are compared with analytical predictions of Chernov and Sutton showing that the uncertainty in predicting laser beam spread in the presence of

random fluctuations has been reduced by a factor of at least 2. Author (GRA)

N77-29506# Naval Postgraduate School, Monterey, Calif.
POWER-DENSITY DISTRIBUTION BELOW THE OCEAN SURFACE DUE TO INCIDENT LASER RADIATION M.S. Thesis
Michael John Milchanowski Mar. 1977 86 p refs
(AD-A039797) Avail: NTIS HC A05/MF A01 CSCL 20/6

The time-averaged power-density distribution below the ocean surface due to incident laser radiation is examined by means of computer simulation of the geometrical optics involved with the air/sea interface and subsequent ocean penetration by the laser beam. The effects over the entire spectra of incidence angles, wind velocities, wind directions, beam spot sizes and depths of penetration are analyzed. Author (GRA)

N77-29507# Harris Corp., Melbourne, Fla. Electronics Systems Div.
OPTICAL TRANSFORM INTERCEPT SYSTEM LASER SCANNER/PHOTODICHROIC EVALUATION Final Technical Report
M. O. Greer Apr. 1977 48 p
(AD-A039716) Avail: NTIS HC A03/MF A01 CSCL 07/2

This report describes the use of an acousto-optic laser scanner to perform MTF, photometric sensitivity and dynamic range measurements on a photodichroic crystal (KF:Li). Signal information was recorded onto the crystal, the spectrum of the recorded signals were obtained, and the signal was recovered by rescanning with an unmodulated laser beam. GRA

N77-29508# Army Environmental Hygiene Agency, Aberdeen Proving Ground, Md.
LASER HAZARD CLASSIFICATION GUIDE
David H. Sliney, Wesley J. Marshall, Pedro F. Del Valle, James K. Franks, and Terry L. Lyon Jul. 1976 213 p refs
(PB-266497/7; DHEW/PUB/NIOSH-76-183; NIOSH-76-183) Avail: NTIS HC A10/MF A01 CSCL 06R

A laser compendium is presented, consisting of almost 2,500 models available from over 175 manufacturers and distributors in the laser safety field, compiled to the technical specifications gathered from manufacturing data sheets. The lasers were classified according to manfacturers' specification and manufacturers' data were confirmed by mesuring a small sample of lasers and cross-checking the calibration of manufacturers' instrumentation. The listing of lasers and their hazard classification is expected to be used in the formulation of the OSHA standard for occupational exposure to laser radiation. GRA

N77-29509# Stanford Univ., Calif. W. W. Hansen Labs. of Physics.
FREE ELECTRON LASER Final Report, 15 Feb. 1975 - 14 Jul. 1976
John M. J. Madey and H. A. Schwettman Dec. 1976 59 p refs
(Contract F44620-75-C-0070; AF Proj. 9768)
(AD-A036601) Avail: NTIS HC A04/MF A01 CSCL 20/5

The objective of this program is the determination of the characteristics and capabilities of laser amplifiers and oscillators based on the stimulated emission of radiation by free electrons in a spatially periodic magnetic field. The previous effort in this program was directed towards the measurement of the single pass gain and the dependence of the gain on electron energy and current, the electron beam radius and divergence, and the amplitude of the magnetic field. Author (GRA)

N77-29510# California Univ., Santa Barbara. Dept. of Physics.
SPECTROSCOPY IN KINETIC STUDIES OF GAS-PHASE REACTIONS Final Report, 1 May 1974 - 31 Aug. 1976
H. P. Broida and R. E. Steele Dec. 1976 10 p
(Grant AF-AFOSR-2724-74; AF Proj. 9538)
(AD-A036534; AFOSR-77-0071TR) Avail: NTIS HC A02/MF A01 CSCL 20/5

New developments in remote sensing, communications, energy systems and other areas of interest depend upon advances in laser technology. Chemical or transfer laser systems hold promise of fulfilling many of these needs. The development of new and better chemical laser systems, however, awaits increased understanding and knowledge of the reactive and spectral characteristics of candidate molecules. The research under this grant has concentrated on obtaining a detailed understanding of metal-oxidant and metal-halogen reactions. Photon yields and product state branching ratios have been determined for many reactions. In many cases it was necessary to develop basic spectroscopic information on the electronically excited product molecules. In the course of these studies, other molecules of atmospheric, combustion, or chemical laser interest also came under scrutiny, and molecular constants were obtained. Various diatomic molecular species have been produced in vacuum flow systems; typically metal vapor entrained in an inert gas is reacted with a halogen or oxidant. These exothermic reactions produce product molecules in excited states whose fluorescence (chemiluminescence) is analyzed. Laser induced fluorescence (photoluminescence) is also used to probe both ground and excited electronic states. The following research summary is organized according to experimental technique. Author (GRA)

N77-29511# Lincoln Lab., Mass. Inst. of Tech., Lexington.
LASER DEVELOPMENT IN SUPPORT OF THE JUMPER PROGRAM FOR LASER ISOTOPE SEPARATION Semiannual Report, 1 Jul. - 31 Dec. 1976
Alan L. McWhorter 31 Dec. 1976 69 p refs
(Contract F19628-76-C-0002)
(AD-A036328; ESD-TR-76-347) Avail: NTIS HC A04/MF A01 CSCL 20/5

This report covers in detail the research and development work carried out by M. I. T. Lincoln Laboratory for the U.S. Energy Research and Development Administration in support of the JUMPer program at the Los Alamos Scientific Laboratory. The topics covered include optically pumped gas lasers, frequency calibration of the CO2 laser, and microwave frequency shifting. GRA

N77-29512# Ohio State Univ., Columbus. ElectroScience Lab.
LASER ATMOSPHERIC ABSORPTION STUDIES Interim Report, 1 Jul. 1975 - 31 Jan. 1976
R. K. Long, E. K. Damon, J. C. Peterson, and M. E. Thomas Griffiss AFB, N.Y. RADC Jan. 1977 167 p refs
(Contract F30602-76-C-0058; ARPA Order 1279)
(AD-A036653; ESL-4232-1; RADC-TR-76-330; IR-1) Avail: NTIS HC A08/MF A01 CSCL 20/5

This report describes progress on the various tasks which comprise the research program. The three major components are Part B: Initial Design Studies For a Cooled Long-Path Absorption Cell, Part C: A Differential Spectrophone of Unique Design, and Part D: Tunable Semiconductor Laser Spectroscopy of CO2, N2O, and H2O in the 5-Micron Region. Author (GRA)

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N77-29513 Polish Academy of Sciences, Warsaw.
OPTIMAL SELECTION OF DRIVING MOMENT FOR A MECHANICAL SYSTEM WITH SLACK [ZADANIE OPTYMALNEGO DOBORU MOMENTU NAPEDOWEGO DLA UKLADU MECHANICZNEGO Z LUZEM]
S. Kotowski, A. Olas, B. Radziszewski, A. Szadkowski, J. Szadkowski, and A. Zaleski Dec. 1976 12 p refs In POLISH Avail: Issuing Activity

Dynamic phenomena are evaluated in power transmission systems which suffered breakdown as a result of brief current interruption. Breakdown of a system consisting of a motor, a power transmission assembly, and a receiver operating in a set state results from a reduction in the driving moment followed by its return to nominal value, causing the parameters of the system (torsion angle) to change to another state. This leads to the breakdown of the power transmission system. Determined are the largest possible parameters of state for a system loaded by the driving moment so that the largest possible parameters

for the system are obtained. It is assumed that there is play in the transmission system. Author

N77-29514 Michigan Univ., Ann Arbor.
PARTICULATE EMISSION FROM A SPARK IGNITION AND A LIGHT DUTY DIESEL ENGINE Ph.D. Thesis
Ander Laresgoiti 1976 98 p
Avail: Univ. Microfilms Order No. 77-7966

The effect of engine load and speed on particulate and smoke emissions was also studied during the tests. The results showed that the particulate emission was insensitive to sampling temperature (within the 300-500 K range achieved in the exhaust), but both the particulate and smoke emissions were highly dependent on engine speed and load. The particulate matter collected was analyzed for its chemical composition showing that 60 to 75 percent (by weight) of the particulate matter was organic compounds. Dissert. Abstr.

N77-29515 Wisconsin Univ., Madison.
A METHOD OF DERIVING A NUMERICAL MODEL FOR AUTOMOBILE ENGINE EMISSIONS
Richard Robert Radtke 1976 257 p
Avail: Univ. Microfilms Order No. 77-3419

A technique for obtaining engine emission flow rate maps has been developed. Conventional techniques for modeling emissions of automobiles use steady-state emissions data from engines mounted on dynamometers. The engine dynamometers are operated at steady conditions of torque and speed to obtain the emission flow rates at each steady-state condition. The dynamic torque and speed requirements of a simulated automobile are then used with the steady-state emissions data to calculate instantaneous emission flow rates. The technique proposed in this thesis does not use the steadystate data to obtain emission flow rate maps. Instead, the maps are developed from the instantaneous emissions of an automobile being driven over a test. Dissert. Abstr.

N77-29516 Wisconsin Univ., Madison.
INVESTIGATION OF THE FUNDAMENTALS OF MECHANICAL PULPING Ph.D. Thesis
David Alan Dornfeld 1976 218 p
Avail: Univ. Microfilms Order No. 77-3396

The study of the production of wood pulp by grinding focuses on several areas of the process- from improvement of fiber quality and process energy consumption to modeling of the wood grinding process to determine wood-stone interaction characteristics. The pulp was produced under controlled conditions utilizing a specially designed and fabricated prototype grinder, and the pulp quality related to several grinding parameters. A pulsed loading technique was also developed to aid in the optimization of the fiberizing process. By tuning the process with variable frequency and amplitude sine-wave-load pulsation, the grinding process can be altered and improvements in fiber quality and energy consumption seen. Dissert. Abstr.

N77-29517 Stanford Univ., Calif.
TESTS FOR GLOBAL OPTIMALITY AND UNBOUNDEDNESS OF ENGINEERING DESIGN SIGNOMIAL Ph.D. Thesis
Barry Whitcomb McNeill 1976 135 p
Avail: Univ. Microfilms Order No. 77-7130

Theorems, rules, constructions, and tests utilizing optimization theory and problem structure are developed. Two sufficient test are given for global optimality based on constructing a lower bounding function that has its global minimum at the local minimum of the original function. Monotonic and zero degree of difficulty signomials are used for the lower bounding functions. The construction cannot always be successfully completed. Four other tests for global optimality are developed using the fact that the global minimum, the tangent hyperplane, intersects the objective function only at the point of tangency. A new function is constructed by taking the difference between the objective function and the tangent hyperplane. The global tests used the factorability and required positivity of this new function. Dissert. Abstr.

N77-29518*# AiResearch Mfg. Co., Torrance, Calif.
LONG LIFE COOLANT PUMP TECHNOLOGY Final Report
Sep. 1976 99 p
(Contract NAS8-28434)
(NASA-CR-150356; AiResearch-76-13009) Avail: NTIS HC A05/MF A01 CSCL 13K

Design concepts were investigated to improve space system coolant pump technology to be suitable for mission durations of two years and greater. These design concepts included an improved bearing system for the pump rotating elements, consisting of pressurized conical bearings. This design was satisfactorily endurance tested as was a new prototype pump built using various other improved design concepts. Based upon an overall assessment of the results of the program it is concluded that reliable coolant pumps can be designed for three year space missions. Author

N77-29519*# Engelhard Minerals and Chemicals Corp., Edison, N.J.
DURABILITY TESTING AT ONE ATMOSPHERE OF ADVANCED CATALYSTS AND CATALYST SUPPORTS FOR AUTOMOTIVE GAS TURBINE ENGINE COMBUSTORS, PART 1 Final Report
R. M. Heck, M. Chang, H. Hess, and R. Carrubba Jun. 1977 231 p refs Sponsored in part by ERDA
(Contract NAS3-19416)
(NASA-CR-135132; CONS-9416-1) Avail: NTIS HC A11/MF A01 CSCL 21B

The durability of catalysts and catalyst supports in a combustion environment was experimentally demonstrated. A test of 1000 hours duration was completed with two catalysts, using diesel fuel and operating at catalytically supported thermal combustion conditions. The performance of the catalysts was determined by monitoring emissions throughout the test, and by examining the physical condition of the catalyst core at the conclusion of the test. The test catalysts proved to be capable of low emissions operation after 1000 hours diesel aging, with no apparent physical degradation of the catalyst support. Author

N77-29520*# Computer Sciences Corp., Huntsville, Ala.
STATUS OF THE ELECTROFORMING SHIELD DESIGN (ESD) PROJECT Interim Report
Rondell E. Fletcher Jun. 1977 25 p
(Contract NAS8-31640)
(NASA-CR-150349) Avail: NTIS HC A02/MF A01 CSCL 13H

The utilization of a digital computer to augment electrodeposition/electroforming processes in which nonconducting shielding controls local cathodic current distribution is reported. The primary underlying philosophy of the physics of electrodeposition was presented. The technical approach taken to analytically simulate electrolytic tank variables was also included. A FORTRAN computer program has been developed and implemented. The program utilized finite element techniques and electrostatic theory to simulate electropotential fields and ionic transport. Author

N77-29521*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELASTOHYDRODYNAMIC LUBRICATION OF ELLIPTICAL CONTACTS FOR MATERIALS OF LOW ELASTIC MODULUS. 1: FULLY FLOODED CONJUNCTION
Bernard J. Hamrock and Duncan Dowson (Leeds Univ., Engl.) Washington Aug. 1977 31 p refs
(NASA-TN-D-8528; E-9216) Avail: NTIS HC A03/MF A01 CSCL 11H

Elastohydrodynamic lubrication concepts of conjunctions of elliptical form are applied to materials of low elastic modulus. The influence of the ellipticity parameter and the dimensionless speed, load, and material parameters on minimum film thickness for these materials has been investigated. The ellipticity parameter was varied from a ball on plate configuration to a configuration approaching a line contact. The dimensionless speed and load parameters were varied by 1 order of magnitude. Seventeen different cases were used to generate minimum and central film thickness relations. Contour plots are presented that illustrate the pressure distribution and film thickness in the conjunction. Author

N77-29522# California Univ., Livermore. Lawrence Livermore Lab.
COMPUTER SIMULATION OF LARGE-DISPLACEMENT

IMPACT DYNAMICS
D. M. Norris, M. VanThiel, and B. Moran Oct. 1976 34 p refs Presented at the SAE Automotive Engineering Congress and Exposition, Detroit, 28 Feb. - 4 Mar. 1977
(Contract W-7405-eng-48)
(UCRL-78734; Conf-770205-1) Avail: NTIS HC A03/MF A01

A two-dimensional Lagrangian explicit finite difference (EFD) computer program was used to simulate three large-deformation dynamic tests: the Charpy V-notch impact toughness test, oblique impact of a cylindrical rod on armor plate, and driving of copper liners by a shaped high-explosive charge. The relationship of the EFD formulation to the more recently developed explicit finite element (EFE) formulation is discussed. ERA

N77-29523# Siemens A.G., Nuremberg (West Germany). Abt. Fertigungstechnische Entwicklung 2.
STUDIES ON SHOCK WAVE GENERATION, MATERIAL STRESS AND TECHNOLOGY OF THE HYDROSPARK METHOD Final Report
Joachim-Friedrich Hammann, Guenter Maerz, Dietrich Scheible, and Helmut Seiffert Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1976 96 p refs In GERMAN; ENGLISH summary
(Contract BMFT-NT-390)
(BMFT-FB-T-76-78) Avail: NTIS HC A05/MF A01; ZLDI, Munich DM 20.20

The hydrospark method and its economical application to production were studied. Investigations of energy transfer from underwater wire explosions form the basis for the development of optimally efficient ignition devices very rapidly replaceable. The production time was reduced to economical values by means of a new type of tool, i. e., an elastic bellows enclosing the medium which transfers the shock waves. The advantages and limitations of the method are explained by examples, and details are given of materials and construction of the tools which can withstand the heavy stresses imposed by shock waves.
Author (ESA)

N77-29524# Politecnico di Torino (Italy). Ist. di Macchine e Motori per Aeromobili.
SIMULATION OF THE PRESSURE BEHAVIOR IN COMBUSTION CHAMBERS OF SPARK IGNITION ENGINES UNDER KNOCK CONDITIONS
Carlo Vincenzo Ferraro Apr. 1976 29 p refs In ITALIAN; ENGLISH summary
(Publ-176) Avail: NTIS HC A03/MF A01

A device for simulation of pressure variation signals is described. The electronic equipment, its useful range, the measurements, and possible control of the simulation pressure variation are discussed. ESA

N77-29525# Aeronautical Research Council, London (England).
THE CURRENT STATE OF RESEARCH AND DESIGN IN HIGH PRESSURE RATIO CENTRIFUGAL COMPRESSORS
P. M. Came 1977 73 p refs Supersedes NGTE-NT-1029 (ARC-CP-1363; NGTE-NT-1029) Avail: NTIS HC A04/MF A01; HMSO £3, PHI $11.55

A review of the achievements of research effort in centrifugal compressors is presented and its effect on current design methods is discussed. Recommendations for future research are made. Author (ESA)

N77-29526# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
WEAK (LEAN) MIXTURE RUNNING OF THE SPARK IGNITION ENGINE
G. G. Lucas May 1976 28 p refs Sponsored by Sci. Res. Council
(TT-7603) Avail: NTIS HC A03/MF A01

The ways in which a weak mixture engine can be made thermally efficient are examined and problem areas in weak mixture running are identified. ESA

N77-29527# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
THE MECHANICS OF STEERING SYSTEMS. PART 1: THE ANALYTICAL GEOMETRY OF STEERED WHEEL MOTIONS
F. D. Hales Feb. 1977 36 p refs
(TT-7701) Avail: NTIS HC A03/MF A01

The need for theoretical/numerical techniques in the design of steering systems is considered and the determination of the location of the tire/ground contact point is discussed. The problem is tackled using three-dimensional analytical geometry and solutions (with appropriate simplifying assumptions) are obtained for both automobile and bicycle steering systems. Sample numerical solutions for the two cases are also presented.
Author (ESA)

N77-29528# Leybold-Heraeus G.m.b.H., Cologne (West Germany). Vacuum Components and Standard Systems Div.
STUDY ON THE USE OF A MODIFIED MAGNETIC BEARING TURBOMOLECULAR PUMP TURBOVAC 100 MSL TO EVACUATE SPACELAB FURNACES
R. Frank, E. Usselmann, M. Brunet, and M. Lacour 29 Apr. 1977 120 p refs Prepared jointly with SEP
(Contract ESA-2858/76-F-WMT(SC))
(ESA-CR(P)-942) Avail: NTIS HC A06/MF A01

The effective pumping speed of the foreseen ventline is in the order of 1 l/sec, which in most cases would be insufficient to achieve pressures below 0.001 torr. The turbomolecular pump Turbovac 100 MSL, studied here, has a pumping speed of 125 l/sec and will improve the pressure in the furnaces by a factor of 10 to 100. The compression of hydrogen of this pump is around 20.000. The proposed pump has a magnetic bearing system for the rotor suspension, which has the advantage of giving an extremely low vibration level (less than 0.01 mm/sec) and power consumption (about 10 W). In addition, magnetic bearings have shown themselves suitable for high speed rotors in zero gravity environment. One aim was to study the feasibility and the yield of manufacturing drawings of the space version of the pump. The improvement of the vacuum conditions were analyzed experimentally with the standard magnetic bearing pump Turbovac 550 M. Author (ESA)

N77-29529# Air Force Packaging Evaluation Agency, Wright-Patterson AFB, Ohio.
PRESSURE TEST OF PPP-C-96-CANS Engineering and Test Data Report
Richard T. Gibbons Feb. 1977 7 p
(AD-A038363; PTPD-77-9) Avail: NTIS HC A02/MF A01 CSCL 13/4

The Air Force Packaging Evaluation Agency (AFPEA) is aware that overprotection is a costly condition that exists in some packaging applications. In an attempt to find lower cost packaging that is qualified to provide equal protection within a certain limit, most cost effective containers are currently being investigated. One such type of container was sent to the AFPEA from Ogden ALC, Hill AFB UT, to determine if this sample was structurally designed to withstand 15 psig pressure without leaking. All container specimens (four each) tested under this project were found to be adequate. There were no leaks found when tested according to the appropriate military specifications.
Author (GRA)

N77-29530# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RESULTS OF THE EXPERIMENTAL STUDY OF THE EFFECT ON COMPRESSOR PARAMETERS FROM WATER ADMITTED AT THE INLET TO A CENTRIFUGAL COMPRESSOR
A. S. Moskalenko and N. L. Zeldes 19 Nov. 1976 24 p refs Transl. into ENGLISH from Samoletostroyeniye i Tekhnika Vozdushnogo flota (Kharkov, USSR), no. 22, 1970 p 39-46
(AD-A039078; FTD-ID(RS)I-1409-76) Avail: NTIS HC A02/MF A01 CSCL 21/5

The following were among the conclusions of this study: (1) Injection of water on suction into a compressor for evaporative cooling of air considerably decreases the air temperature on exit from the compressor; (2) During compressor tests, total evaporation of the injected moisture occurred to the state of saturation with different turns and different positions of the butterfly valve; (3) Evaporative cooling of air during compression in a region of high flow rate in connection with the increase in air density on the exit from the impeller. GRA

N77-29531# Boeing Commercial Airplane Co., Renton, Wash.
AN EXTENDED PREDICTION MODEL FOR AIRPLANE

BRAKING DISTANCE AND A SPECIFICATION FOR A TOTAL BRAKING PREDICTION SYSTEM, VOLUME 1 Final Report, Aug. 1975 - Dec. 1976
M. Wahi, S. M. Warren, and H. H. Straub Mar. 1977 131 p refs
(Contract F33657-74-C-0129)
(AD-A039966; ASD-TR-77-6-Vol-1) Avail: NTIS HC A07/MF A01 CSCL 01/2

A sensitivity analysis of airplane braking distance was conducted on a hardware-analog brake control simulator for the USAF B-52, KC-135 and F-111 airplanes. Using dimensional analysis a braking distance prediction equation was developed for each airplane. The results of this study were combined/compared with the braking prediction equations developed, for five other airplanes, Boeing 727, 737 and 747 and USAF C-141 and F-4, under a similar previously contracted effort. The resulting braking prediction subsystem (BPSS) model (equations) are shown to be compatible and valid. The BPSS has been integrated with a ground Friction Prediction Subsystem (FPSS) and specification criteria is developed for this Total Braking Prediction System (TBPS). A test program is also outlined to verify the effectiveness and reliability of the TBPS. Author (GRA)

N77-29532# Boeing Commercial Airplane Co., Renton, Wash.
TIRE RUNWAY INTERFACE FRICTION PREDICTION SUBSYSTEM Final Report, May - Dec. 1975
M. Wahi and H. H. Straub Mar. 1977 202 p refs
(Contract F33657-74-C-0129)
(AD-A039968; ASD-TR-77-7) Avail: NTIS HC A10/MF A01 CSCL 01/2

An analytical tire model was developed that correlates with existing tire test data to within + or - 5%. The model consists of a prediction equation expressing the relationships between seven dimensionless groups (pi terms) needed to define the aircraft tire-runway interface friction. A tire test program was recommended to validate the said model. A specification criteria has been established for the interface Friction Prediction Subsystem and various ground vehicles in use to date were evaluated. None of the vehicles meet the specification criteria. GRA

N77-29533# Wapora, Inc., Washington, D. C.
ASSESSMENT OF INDUSTRIAL HAZARDOUS WASTE PRACTICES. SPECIAL MACHINERY MANUFACTURING INDUSTRIES Final Report, Jun. 1975 - Mar. 1977
James Levin and Gene Beeland Mar. 1977 328 p refs
(Contract EPA-68-01-3193)
(PB-265981/1; EPA-530/SW-141c) Avail: NTIS HC A15/MF A01 CSCL 13/4

Specific process waste types are characterized as to their chemical constituents and physical properties. Treatment and disposal technologies and attendant costs for each category of process wastes are described at three levels of technology: the most prevalent technology currently in use, best technology currently employed and technology for adequate health and environmental protection. Total process waste and hazardous constituent quantities were estimated for each of the five categories in two industries on a national level and disaggregated by EPA Regions and states. GRA

N77-29534# National Highway Traffic Safety Administration, Washington, D. C. Safety Research Lab.
A COMPARISON OF TIRE TRACTION TEST METHODS: MOBIL TIRE TRACTION DYNAMOMETER VS INSTRUMENTED PASSENGER CAR
A. H. Neill, Jr. and J. A. Hinch Feb. 1977 74 p
(PB-266642/8; DOT-HS-802-342) Avail: NTIS HC A04/MF A01 CSCL 13F

Two completely different test methods are compared for their ability to quantify the traction characteristics of high speed police pursuit tires. The first uses established instrumented vehicle test procedures while the second method users the mobile tire traction dynamometer. GRA

N77-29535# Pennsylvania State Univ., University Park. Applied Research Lab.
VISCOUSLY DAMPED DYNAMIC ABSORBERS OF CONVENTIONAL AND NOVEL DESIGN
M. A. Nobile and J. C. Snowden 10 Dec. 1976 51 p refs
(Contract N00017-73-C-1418; SF43452702)
(AD-A036684; TM-76-308) Avail: NTIS HC A04/MF A01 CSCL 20/11

The behavior of dynamic vibration absorbers of conventional and novel design has been investigated experimentally and found to compare closely with prediction. The dynamic absorbers were employed to suppress the transmissibility at resonance across a one-degree-of-freedom primary system. Initially considered was a dynamic absorber with a conventional mass-spring-dashpot configuration; the primary system was undamped. Subsequently considered were (1) so-called dual dynamic absorbers, and (2) a single, nominally undamped absorber, or two such absorbers, attached to the primary system after it had been damped heavily. The dual absorbers -- a conventional viscously damped absorber used in parallel with a less massive undamped absorber -- introduced a pronounced transmissibility trough without the appearance of unwanted 'compensating' peaks at lower and higher frequencies. The attachment of a nominally undamped absorber to the heavily damped primary system also introduced a pronounced trough without giving rise to compensating peaks. Further, the attachment of two such absorbers introduced pronounced troughs at two frequencies that could be varied independently of one another. Thus, the novel absorber systems considered here behaved as mechanical 'notch' filters, providing at specific 'low' frequencies a high degree of isolation that other passive systems cannot duplicate without exhibiting a marked loss in isolation at neighboring frequencies. GRA

N77-29536# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
STAKE DRIVING TOOLS. A PRELIMINARY SURVEY
Austin Kovacs and Ronald T. Atkins May 1977 50 p refs
(AD-A041053; CRREL-SR-77-13) Avail: NTIS HC A03/MF A01 CSCL 13/13

The military has frequently encountered difficulty in installing and removing anchors in the field where hard frozen ground exists. This difficulty has often precluded rapid deployment of military hardware requiring anchors for their stability or support. This report gives results of a study of four commercial breaker-rock drills, a prototype hydraulic stake driver-retriever and a prototype propellant-actuated hammer which were evaluated for the driving of anchors into hard frozen ground. The tests found that commercial breaker-rock drills can be used without modification to drive standard military GP-112/G and GP-113/G stakes into frozen ground. The study revealed that, while the hydraulic stake driver would require further development to increase its reliability, it could drive the above stakes into frozen ground. The propellant-actuated stake driver was found incapable of driving stakes into hard frozen ground and was not considered worthy of further development as a stake driver. Author (GRA)

N77-29537# Army Foreign Science and Technology Center, Charlottesville, Va.
INVESTIGATION OF THE OPERATION OF THE FUEL SUPPLY SYSTEM IN A TORCH IGNITION ENGINE WITH LIGHT FUEL INJECTION
N. A. Kerimov and R. I. Mekhtiyev 7 Sep. 1976 13 p refs
Transl. into ENGLISH from Za Tekhn. Progr. (USSR), no. 7, 1967 p 43-46
(AD-B019444L; AST-1840I-002-75; FSTC-1550-75) Avail: NTIS HC A02/MF A01 CSCL 21/2

The following topics are discussed: internal combustion engines; fuel systems; foreign technology; torches; ignition; fuel injection; fuel nozzles; diesel engines; and fuel air ratio. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N77-29538 Georgia Inst. of Tech., Atlanta.
A GENERAL APPROACH TO THE CALCULATION OF RELIABILITY INDICES FOR AN ELECTRIC POWER TRANSMISSION SYSTEM Ph.D. Thesis

Thomas Pierce Hayes, Jr. 1976 135 p
Avail: Univ. Microfilms Order No. 77-7793

The effect of overloaded lines is analyzed with the use of sensitivity factors. These sensitivity factors are calculated from the decoupled reactive power flow equations and represent the change in line flow in a line due to a change in power flow at a bus. These sensitivity factors eliminate the need for repeated solutions of the load flow equations each time an overloaded line is located. In order to evaluate this procedure, the results of the procedure are compared with a Monte Carlo simulation of a 90-bus network. The procedure is also compared to previous conditional probability methods on three-and five-bus networks. Dissert. Abstr.

N77-29539*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
REAL-TIME RADIOGRAPHIC INSPECTION FACILITY
Ernest Roberts, Jr. Washington Aug. 1977 21 p refs
(NASA-TN-D-8529; E-9156) Avail: NTIS HC A02/MF A01 CSCL 14D

A real time radiographic inspection facility has been developed for nondestructive evaluation applications. It consists of an X-ray source, an X-ray sensitive television imaging system, an electronic analog image processing system, and a digital image processing system. The digital image processing system is composed of a computer with the necessary software to drive the overall facility. Descriptions are given of the design strategy, the facility's components, and its current capabilities. Author

N77-29540# Institut fuer Festkoerpertechnologie, Munich (West Germany).
MEASUREMENT OF MINORITY CARRIER LIFETIME IN SILICON CRYSTALS TO DETERMINE MATERIAL QUALITY Final Report
Helmut Bernt, Guenther Schwab, Alfred Eder, and Hans-Peter Spoehrle Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1976 92 p refs In GERMAN; ENGLISH summary
(Contract BMFT-NT-259)
(BMFT-FB-T-76-67) Avail: NTIS HC A05/MF A01; ZLDI, Munich DM 19.35

A new method was developed to measure the minority carrier lifetime in silicon. The frequency dependence of the photocurrent of a Schottky contact irradiated with sine modulated light was investigated. It can be shown that in a suitable frequency range the photocurrent has a phase delay to the incident light which is proportional to the lifetime. Therefore the results can be evaluated easily. The use of a mercury-Schottky-contact makes possible nondestructive measurements and spatial resolution (lifetime profiles). Author (ESA)

N77-29541# AEG-Telefunken, Heilbronn (West Germany). Fachbereich Halbleiter.
PHYSICS OF FAILURE SOURCES IN SEMICONDUCTOR DEVICES Final Report
Hermann Clauss Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1976 116 p refs In GERMAN; ENGLISH summary
(Contract BMFT-NT-372)
(BMFT-FB-T-76-77) Avail: NTIS HC A06/MF A01; ZLDI, Munich DM 24.40

Investigations on failure mechanisms that may cause defects during production and operation of silicon semiconductor devices are described. The failure analysis of aluminum metallization defects covers topics such as step coverage, dissolution pits, and electromigration. The generation of process induced lattice defects was also investigated. Improved processes avoiding those defects were developed. Author (ESA)

N77-29542# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Strukturmechanik.
NEW TEST METHODS FOR THE PREDICTION OF ENVIRONMENTAL RESISTANCE OF ADHESIVE BONDED METAL JOINTS
W. Althof 16 Aug. 1976 16 p refs
(DLR-IB-152-76/17) Avail: NTIS HC A02/MF A01

By investigations over several years of numerous structural adhesives for aircraft construction it could be shown that the test methods used are qualified for estimating the aging resistance of an adhesive against its environment. Author (ESA)

N77-29543# Syracuse Univ., N. Y. Dept. of Industrial Engineering and Operations Research.
MANUAL FAULT DETECTION TEST SET MINIMIZATION Final Technical Report, Jun. - Oct. 1976
John Knaizuk, Jr. May 1977 26 p
(Contract F30602-71-C-0312)
(AD-A040085; TR-76-9; RADC-TR-77-149) Avail: NTIS HC A03/MF A01 CSCL 14/2

This report describes a manual procedure for minimizing the number of tests necessary to detect a single stuck-at fault in a large scale integrated circuit. Author (GRA)

N77-29544# Southwest Research Inst., San Antonio, Tex.
AN INVESTIGATION OF FLUX DENSITY DETERMINATIONS - Final Report, 1 Jul. - 31 Dec. 1976
Robert E. Beissner Dec. 1976 79 p refs
(AD-A040117; SwRI-15-4618; AFML-TR-76-236) Avail: NTIS HC A05/MF A01 CSCL 14/2

Two unresolved problems associated with magnetic particle inspection are analyzed. These are the determination of flux density requirements and the measurement of flux densities in specimens to be inspected. It is concluded that the development of a mathematical model for the prediction of flux density requirements will require the determination of detectability criteria, the development of a theory of time-dependent diffusion of particles in inhomogeneous fields, and the development of methods for predicting flux leakage distributions associated with flaws. Also, it is suggested that Hall probe measurements of tangential field strengths at the surface of a specimen are probably adequate as a preinspection step to insure proper magnetization. A recommended program of research leading to the development and experimental verification of a mathematical model, and the development of appropriate flux density instrumentation, is presented. Author (GRA)

N77-29545# Naval Postgraduate School, Monterey, Calif.
DECISION VERIFICATION AS AN ELEMENT OF NAVY QUALITY ASSURANCE PROGRAMS M.S. Thesis
Wayne L. Chadwick Mar. 1977 58 p refs
(AD-A039158) Avail: NTIS HC A04/MF A01 CSCL 05/1

Decision verification in quality assurance is simply the Government's determination of whether or not a contractor's inspection decisions are correct. This paper discusses procedures for accomplishing decision verification both as prescribed by directives and as actually done. It examines reasons why decision verification does not appear to be a viable element in current quality assurance programs even though this procedure is still prescribed in Navy directives for use by contract administrators. The use of operating characteristic curves as a managerial aid to determine whether or not to use decision verification is also discussed. Author (GRA)

N77-29546# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
A COMPARISON OF VARIOUS NON-DESTRUCTIVE INSPECTION PROCESSES USING HOT ISOSTATICALLY PRESSED POWDER TURBINE PARTS Final Report, Jun. 1975 - Jun. 1976
Donald E. Nulk Dec. 1976 176 p refs
(Contract DAAJ01-75-C-0894)
(AD-A040333; USAAVSCOM-TR-76-23) Avail: NTIS HC A09/MF A01 CSCL 14/2

Four emerging NDE (non destructive evaluation) processes were explored using aircraft turbine rotating hardware or simulated samples as test specimens. The material was a high strength nickel-base alloy, Rene: 95, which was made by hot isostatically pressing powder. The bases of comparison were conventional FPI (fluorescent penetrant inspection) and conventional ultrasonic testing. Neutron radiography and radiographic tomography appear to have insufficient capabilities for NDE of this type of turbine hardware. Conversely, acoustical holography and photon scattering (Compton) methods offer much promise. Both are readily adaptable to fully automatic inspection of hardware. Both appear cost effective based on projected production inspection costs. Both make it possible to reduce metal envelopes of raw material thus decreasing material costs. The acoustical holography process represents a later stage of development than the photon scattering method, but both processes require additional

development effort to obtain a production process. Much of this effort is in computer hardware and software which would reduce inspection time and permit calibration of equipment. Results of inspection scans of test specimens are presented and compared to this report. Specific recommendations for continued effort is also outlined. Author (GRA)

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N77-29547 Illinois Univ., Urbana-Champaign.
LINEAR ELASTIC AND ELASTO-PLASTIC STRESS ANALYSIS FOR ADHESIVE LAP JOINTS Ph.D. Thesis
An-Ton Liu 1976 240 p
Avail: Univ. Microfilms Order No. 77-9079

A finite element stress analysis for adhesive lap joints subjected to a general loading condition which consisted of a tensile force, a shear force, and a bending moment applied at the ends of the adherends was considered. Joints with both identical and non-identical adherends were studied. Stress distributions and concentrations in the adhesive layer for different joint parameters (geometries, material properties, and loading conditions) were studied and compared. The reduction of stress concentrations and the redistribution of stresses due to plastic deformations of the adhesive were studied and compared to the linear elastic solution. Dissert. Abstr.

N77-29548 Georgia Inst. of Tech., Atlanta.
THREE-DIMENSIONAL LINEAR ELASTIC FRACTURE MECHANICS ANALYSIS BY A DISPLACEMENT HYBRID FINITE ELEMENT MODEL Ph.D. Thesis
K. Kathiresan 1976 225 p
Avail: Univ. Microfilms Order No. 77-7794

A finite-element procedure for the calculation of Modes 1, 2 and 3 stress-intensity factors which vary along an arbitrarily curved three-dimensional crack front in a structural component is presented. The finite-element model is based on a modified variational principle of potential energy with relaxed continuity requirements for displacements at the inter-element boundary. The variational principle is a three field principle, with arbitrary interior displacements for the element, inter-element boundary displacements, and element boundary tractions as variables. The unknowns in the final algebraic system of equations, in the present displacement-hybrid finite element model, are the nodal displacements and the three elastic stress-intensity factors along the crack front. Dissert. Abstr.

N77-29549 Akron Univ., Ohio.
APPLICATION OF FINITE EXPONENTIAL FOURIER TRANSFORMS TO THE FINITE ELEMENT ANALYSIS OF NONSYMMETRICALLY LOADED ANISOTROPIC SOLIDS OF REVOLUTION Ph.D. Thesis
John Lawrence Frater 1976 122 p
Avail: Univ. Microfilms Order No. 77-8643

Improved finite elements for the stress analysis of anisotropic axisymmetric solids subjected to nonsymmetric loads are developed. It is demonstrated that the classical half Fourier series expansion of the loads and displacements in the circumferential direction does not satisfy the equilibrium equations of the theory of elasticity for an anisotropic soliid of revolution, while a full Fourier series expansion in the form of a finite exponential Fourier transform does. Numerical results demonstrate that elements 1 and 2 yield identical results for isotropic and orthotropic materials; however, for anisotropic materials differences as high as 52.8 percent were observed. Element 3 results compared well with shell theory results for Anisotropic thin-shell structures. Dissert. Abstr.

N77-29550 Illinois Univ., Urbana-Champaign.
CONSERVATION LAWS IN ELASTICITY OF THE J-INTEGRAL TYPE Ph.D. Thesis
Francis Hap-Kwong Chen 1976 62 p
Avail: Univ. Microfilms Order No. 77-8955

Laws for a class of membranes inflated by pressure are derived and applied to a cylindrical membrane. For infinitesimal deformations of linear elastic bodies, new laws which relate two independent equilibrium states are presented and applied to the problem of a line crack in a plate under mixed-mode loading conditions. A relation is shown to exist between the J-integral and the reciprocal work theorem of Betti. A method to use Betti's theorem to determine the stress intensity factors associated with a crack in a linear elastic plate of finite dimensions is described. The method is then applied to a circular plate with a central crack through the use of an iterative procedure. Dissert. Abstr.

N77-29551 Stanford Univ., Calif.
THE OPTIMIZATION OF STRUCTURES WITH COMPLEX CONSTRAINTS VIA A GENERAL OPTIMALITY CRITERIA METHOD Ph.D. Thesis
Paulo Rizzi 1976 187 p
Avail: Univ. Microfilms Order No. 77-7156

An algorithm is developed for the minimum weight design of structures of structures subject to several non-linear inequality constraints. The structural weight is considered to depend linearly on the design variables. The algorithm is based on a simple recursion formula derived from the Kuhn-Tucker necessary conditions for optimality. The Gauss-Seidel iterative method for linear systems is used to determine the set of active constraints. Minimum-weight design of one-dimensional, elastic structures under dynamic loading is studied. Methods of optimal control theory are applied to a cantilever bar driven sinusoidally by an axial force at the tip. Constraints include maximum allowable stress amplitude at any point along the bar, and minimum cross-sectional area. Dissert. Abstr.

N77-29552 California Univ., Los Angeles.
A MULTILEVEL APPROACH IN OPTIMUM DESIGN OF STRUCTURES INCLUDING BUCKLING CONSTRAINTS Ph.D. Thesis
Rappal Krishnan Ramanathan 1976 243 p
Avail. Univ. Microfilms Order No. 77-8529

Optimum design of truss and wing structures including size, strength, displacement, local and system buckling constraints is presented. A feasible design vector describing the overall proportions of the structure and the detailed dimensions of the component is obtained from each stage of the multilevel design procedure. The importance of including local and system buckling constraints in optimum design procedures is underscored by the numerical results of this study. Finally some potential extensions of the multilevel method are pointed out, particularly the relative ease with which other types of components could be used with only minor modifications at the system level. Dissert. Abstr.

N77-29553 California Univ., Los Angeles.
FATIGUE CRACK INITIATION AND PROPAGATION IN PEARLITIC RAIL STEELS Ph.D. Thesis
Gary Jefferson Fowler 1976 401 p
Avail: Univ. Microfilms Order No. 77-7664

Fatigue crack initiation and growth has been examined in pearlitic rail steels to determine the effect of non-metallic inclusions and grain boundary ferrite on crack initiation and the rates of crack propagation under Mode I loading at ambient temperature. The influence of alternating and maximum stress intensity on fatigue crack propagation in these materials has also been evaluated. The initiation data were obtained using rotating beam specimens tested in reverse bending on a rotating beam machine. The propagation data were obtained using single-edge notch specimens that were cyclic loaded on a hydraulic test machined at various R ratios. All specimens were machined either from the head of rails or from the web or tread of wheels. Fatigue initiation is shown to occur at sulfide inclusions located near the surface. The initiation data show that the endurance limit in the rail steels is a strong function of the inclusion content when the sulfide stringer inclusions are aligned parallel to the specimen axis. Dissert. Abstr.

N77-29554*# Boeing Aerospace Co., Seattle, Wash. Missile and Armament Div.

EFFECTS OF DAMPING ON MODE SHAPES, VOLUME 1 Final Report
Richard M. Gates 27 Jun. 1977 322 p refs 2 Vol.
(Contract NAS8-31369)
(NASA-CR-150357; D180-20572-1-Vol-1) Avail: NTIS HC A14/MF A01 CSCL 20K

Displacement, velocity, and acceleration admittances were calculated for a realistic NASTRAN structural model of space shuttle for three conditions: liftoff, maximum dynamic pressure and end of solid rocket booster burn. The realistic model of the orbiter, external tank, and solid rocket motors included the representation of structural joint transmissibilities by finite stiffness and damping elements. Methods developed to incorporate structural joints and their damping characteristics into a finite element model of the space shuttle, to determine the point damping parameters required to produce realistic damping in the primary modes, and to calculate the effect of distributed damping on structural resonances through the calculation of admittances. Author

N77-29555*# Boeing Aerospace Co., Seattle, Wash. Missile and Armament Div.
EFFECTS OF DAMPING ON MODE SHAPES, VOLUME 2 Final Report
Richard M. Gates, D. H. Merchant, and J. L. Arnquist 27 Jun. 1977 841 p 2 Vol.
(Contract NAS8-31369)
(NASA-CR-150358; D180-20572-2-Vol-2) Avail: NTIS HC A99/MF A01 CSCL 20K

Displacement, velocity, and acceleration admittances were calculated for a realistic NASTRAN structural model of space shuttle for three conditions: liftoff, maximum dynamic pressure and end of solid rocket booster burn. The realistic model of the orbiter, external tank, and solid rocket motors included the representation of structural joint transmissibilities by finite stiffness and damping elements. Data values for the finite damping elements were assigned to duplicate overall low-frequency modal damping values taken from tests of similar vehicles. For comparison with the calculated admittances, position and rate gains were computed for a conventional shuttle model for the liftoff condition. Dynamic characteristics and admittances for the space shuttle model are presented. Author

N77-29556*# Sheldahl Co., Northfield, Minn.
THE EFFECT OF CONFIGURATION ON STRENGTH, DURABILITY, AND HANDLE OF KEVLAR FABRIC-BASED MATERIALS Final Report
L. L. Reuter and J. B. Munson Washington NASA Jul. 1977 65 p refs
(Contract NAS1-12701)
(NASA-CR-2738) Avail: NTIS HC A04/MF A01 CSCL 11G

Five Kevlar based laminates and three Kevlar based coated materials were designed, hand made, and tested against comparative conventional Dacron based materials for strength, peel, tear, puncture, creases, and handle. Emphasis was placed on evaluating geometric orientation of constituents, use of elastomeric film in place of high modulus films, and the use of flying thread loom bias reinforcement of Kevlar yarns. Whereas, the performance of the Kevlar laminates was severely degraded by crease effects, significant gains in overall performance factors were shown for the coated Kevlar materials. Author

N77-29557*# Denver Univ., Colo.
EVALUATING OF NASA-LANGLEY RESEARCH CENTER EXPLOSION SEAM WELDING Final Report
H. E. Otto and R. Wittman Washington Aug. 1977 23 p ref
(Contract NAS1-13817)
(NASA-CR-2874) Avail: NTIS HC A02/MF A01 CSCL 13M

An explosion bonding technique to meet current fabrication requirements was demonstrated. A test program was conducted on explosion bonded joints, compared to fusion joints in 6061-T6 aluminum. The comparison was made in required fixtures, non-destructive testing, static strength and fatigue strength. Author

N77-29558*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SCANNING-ELECTRON-MICROSCOPY OBSERVATIONS AND MECHANICAL CHARACTERISTICS OF ION-BEAM-SPUTTERED SURGICAL IMPLANT ALLOYS
Albert J. Weigand, M. Lise Meyer, and Jerri S. Ling Washington Aug. 1977 33 p refs
(NASA-TM-X-3553; E-9056) Avail: NTIS HC A03/MF A01 CSCL 11F

An electron bombardment ion thruster was used as an ion source to sputter the surfaces of orthopedic prosthetic metals. Scanning electron microscopy photomicrographs were made of each ion beam textured surface. The effect of ion texturing an implant surface on its bond to bone cement was investigated. A Co-Cr-W alloy and surgical stainless steel were used as representative hard tissue implant materials to determine effects of ion texturing on bulk mechanical properties. Work was done to determine the effect of substrate temperature on the development of an ion textured surface microstructure. Results indicate that the ultimate strength of the bulk materials is unchanged by ion texturing and that the microstructure will develop more rapidly if the substrate is heated prior to ion texturing. Author

N77-29559# Tennessee Univ., Knoxville. Dept. of Mechanical and Aerospace Engineering.
EXPERIMENTAL STRESS ANALYSIS OF THE ATTACHMENT REGION OF HEMISPHERICAL SHELLS WITH ATTACHED NOZZLES. PART 2B: RADIAL NOZZLE 7.875 IN. O.D.-7.500 IN. I.D. 10.00 IN. PENETRATION
R. L. Maxwell, R. W. Holland, and G. R. Stengl Jun. 1970 203 p
(Contract W-7405-eng-26)
(ORNL-Sub-2203-5; ME-7-70-1) Avail: NTIS HC A10/MF A01

The results are presented of investigations conducted on a hemisphere with a radial nozzle of 7.875 in. I.D. and 7.500 in. I.D. and 10 in. penetration into the hemisphere. Stress values were determined for the following five types of loadings: (1) internal pressure applied to the hemisphere and nozzle assembly, (2) an axial load applied collinear with nozzle, (3) a pure bending moment, or axial couple, applied to the nozzle, (4) a transverse or shear load applied normal to the nozzle, and (5) a pure torque applied in the radial plane of the nozzle. ERA

N77-29560# Battelle Columbus Labs., Ohio.
STRESS ANALYSIS OF PERFORATED PLATES AND PLATES WITH SINGLE AND CLUSTERED NOZZLES Annual Report
L. E. Hulbert, A. T. Hopper, and E. F. Rybicki 9 Oct. 1976 254 p refs
(Contracts W-7505-eng-26)
(ORNL-Sub-3223-2; AR-2) Avail: NTIS HC A12/MF A01

Computer programs have been developed for the accurate analysis of the in-plane stresses of arbitrary multiholed plates. Stress interactions also occur between closely spaced nozzles attached to pressure vessels such as nuclear reacter vessels. Results of the investigations carried out during the second year of the research program are summarized. The first section of the report describes the structures analyzed, the loadings on these structures, and the mathematical statements of these problems. The second section explains the analysis techniques employed. The third section deals with the numerical results obtained for all of the problems solved. This section also gives a complete statement of each problem and the series of trial functions used to solve each nozzle-plate problem. ERA

N77-29561# Tennessee Univ., Knoxville. Dept. of Engineering Mechanics.
EXPERIMENTAL STRESS ANALYSIS OF CLUSTERS OF HOLES OF EQUAL DIAMETERS IN FLAT PLATES. PART 1: A SINGLE HOLE
A. Mathews Apr. 1969 327 p refs
(Contracts W-7405-eng-26; SUB-2673)
(ORNL-Sub-2673-1-Pt-1) Avail: NTIS HC A15/MF A01

The analysis of flat plates with clusters of holes is a preliminary step to an extensive experimental study of flat plates containing clusters of closely spaced nozzles. Results of the analysis of plates with a single hole are presented. Author (ERA)

N77-29562# Battelle Pacific Northwest Labs., Richland, Wash.
UTILIZATION OF ULTRASONIC TOMOGRAPHY FOR THE

MAPPING OF RESIDUAL STRESS FIELDS IN THICK METAL SECTIONS Final Report
B. P. Hildebrand and D. C. Hufferd Jan. 1977 45 p refs
(EPRI Proj. 504-1)
(EPRI-NP-338) Avail: NTIS HC A03/MF A01

Preliminary work is described aimed at evaluating computerized reconstruction of velocity fields from velocity profiles to map residual stress concentrations in thick metal sections. Experimental results with liquid and solid models are described. One could image velocity anomalies of 0.2 percent and estimate that 0.05 percent is technically feasible. It is concluded that this technique has great potential for finding and mapping residual stress in thick metal sections. ERA

N77-29563# Central Technical Inst. TNO, Apeldoorn (Netherlands).
EFFECT OF FLOW PROPERTIES ON APARTMENT BUILDING MODEL WIND PRESSURES. PART 2: WIND TUNNEL RESULTS [DE INVLOED VAN DE EIGENSCHAPPEN VAN DE AANKOMENDE STROMING OP DE WINDDRUKKEN OP MODELLEN VAN EEN FLATGEBOUW. DEEL 2: RESULTATEN IN DE WINDTUNNEL]
J. A. Leene May 1975 43 p refs In DUTCH
(CTI-ST-717-75-04335) Avail: NTIS HC A03/MF A01

Results of wind pressure measurements on apartment building models in a boundary layer wind tunnel are discussed. The effect of the approaching flow characteristics on the measured wind loads was investigated by varying the velocity gradient and the turbulence separately and simultaneously. The agreement of the results with reality is discussed. ESA

N77-29564# Dornier-System G.m.b.H., Friedrichshafen (West Germany).
DYNAMIC BEHAVIOR OF STOCHASTICALLY EXCITED AIRCRAFT STRUCTURES FOR DETERMINATION OF STRESS AND LIFE [UNTERSUCHUNG DES DYNAMISCHEN VERHALTENS STOCHASTISCH ERREGTER FLUGZEUGSTRUKTUREN ZUR ERMITTLUNG DER SPANNUNGEN UND DER LEBENSDAUER]
M. Rother Bonn DOKZENTBW 1976 56 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung (BMVG-FBWT-76-25) Avail: NTIS HC A04/MF A01; DOKZENTBw, Bonn DM 30

Based on the general random response theory and considering the peculiarities valid for technical random processes, an engineering procedure was derived to calculate structural response. The assumptions refer to small damping and phase coincidence of the exciting forces. The procedure was applied to aircraft skin panels subjected to jet noise loading. This was achieved by means of the finite element method and modal analysis. The maximum rms stresses were calculated for plane and simply curved skin panels. The varieties of important structural parameters considered includes the aspect ratio, skin thickness, and curvature, as well as the elasticity of the stiffening frames and stringers. The results correspond well with the AGARD design data. The analysis of individual rigidly fixed skin panels in place of the actual structure proved this sufficient. A simple test structure was investigated analytically and experimentally, with and without consideration of the phase information, to test the influence of phase differences of the exciting forces. It became apparent that the simplified calculation procedure supplies conservative results for the maximum values of the structural response. Measures to estimate fatigue life are discussed. It is possible to determine the number of cycles to failure for the investigated structures in good approximation by means of the lowest natural frequency. Author (ESA)

N77-29565# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
RATE EFFECTS ON RESIDUAL STRENGTH OF FLAWED STRUCTURES AND MATERIALS
H. P. vanLeeuwen and L. Schra 22 Dec. 1975 81 p refs
(Contract LI/LW/4969)
(NLR-TR-76004-U) Avail: NTIS HC A05/MF A01

The literature is reviewed with respect to tests conducted to investigate crack re-initiation under dynamic loads and arrest of a running crack; metallurgical sources of rate effects; available data for aerospace engineering materials; and mechanical sources of rate effects, dynamic crack tip stresses and kinetic energy effects. Conclusions are drawn and recommendations made. Author (ESA)

N77-29566# Southampton Univ. (England). Inst. of Sound and Vibration Research.
STRUCTURAL RESPONSE UNDER TURBULENT FLOW EXCITATIONS
Y. K. Lin Aug. 1976 52 p refs Sponsored by Sci. Res. Council
(ISVR-TR-80) Avail: NTIS HC A04/MF A01

Three problems of random vibration are discussed. In each case the external excitation is a turbulent flow. The first two problems, an airplane flying into atmospheric turbulence and a panel-like structure exposed to boundary-layer pressure fluctuation, are treated as linear problems. It is shown that if Taylor's hypothesis of a frozen turbulence field is valid then the calculation can be greatly simplified using a spectral analysis in the wave-number domain. However, if decay in the turbulence is appreciable a superposition scheme can still be used to retain as much computational advantage of the wave-number domain analysis as possible. The third problem, the response of a building to a gusty wind, is formulated as a nonlinear problem in which random inputs occur both as parametric and non-parametric excitations. The stochastic averaging method of Stratonovich and Khasminskii is used to obtain equivalent Ito equations for the along-wind motion and the cross-wind motion. Stability conditions are established for the second moment in the along-wind direction and for the first moment in the cross-wind direction. The stationary second moment for the along-wind motion, when it is stable, is also obtained. Author (ESA)

N77-29567# Southampton Univ. (England). Inst. of Sound and Vibration Research.
STRUCTURAL MODELLING BY THE CURVE FITTING OF MEASURED FREQUENCY RESPONSE DATA
H. G. D. Goyder Oct. 1976 46 p refs Sponsored by Min. of Defence (Admiralty Eng. Lab.)
(ISVR-TR-87) Avail: NTIS HC A03/MF A01

A method for deriving the vibration characteristics of a structure from a set of measured frequency response functions is presented. A general mathematical model is formulated which makes no assumptions concerning the vibrational behavior of any particular structure. This model is then employed in a curve fitting procedure which enables the parameters employed by the model to be determined from a set of measured data. The model parameters are directly meaningful, being in the form of complex resonance frequencies and mode shapes. It is shown that once constructed, the model may be used to predict frequency response functions which have not been measured. Consequently only one excitation station need be used when measuring the transfer functions of a structure. Practical measurements taken from a beam are used to demonstrate the capability of the modelling technique to represent a structure. Author (ESA)

N77-29568# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.
THREE-FIELDS VARIATIONAL THEOREMS FOR THE RATE PROBLEM OF FINITE STRAIN ELASTO-PLASTICITY WITH DISCONTINUOUS FIELDS
M. Kleiber (Inst. of Fundamental Technol. Res., Warsaw) Oct. 1976 22 p refs
(ISD-207) Avail: NTIS HC A02/MF A01

With a view toward a numerical solution by means of the finite element method a variational statement for elasto-plastic deformations at finite strain is given which involves independent variation of the velocity, the strain-rate, and stress-rate fields, and which includes both the boundary and the jump conditions. An elasto-plastic hardening solid in quasi-static state is considered. Both Eulerian and Lagrangian formulations of this general variational principle are given. It is shown that certain variational principles due to Murphy and Lee, and Neale may be considered as special cases of the newly established theorem. By way of illustration a finite-element formulation of the problem considered is presented, using three independent fields, where each field is approximated by a piecewise-linear function within each element. Author (ESA)

N77-29569# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

RESIDUAL STRENGTH DATA OF RIVETED PANELS WITH DIFFERENT STIFFENER CONFIGURATIONS

H. Vlieger 10 Mar. 1976 28 p refs
(Contract NIVR-1705)
(NLR-TR-76033-U) Avail: NTIS HC A03/MF A01

Residual strength tests were carried out on center-cracked panels with a 2024-T3 or 7075-T6 skin and provided with eccentric stiffeners of practical design. The stiffeners were riveted to the skin. The material of the stiffeners was 7075-T6. In some cases the stiffeners were combined with Ti-alloy crack stoppers. On the basis of the test results the effects of different panel parameters and material properties on the residual strength characteristics of the various panel configurations were evaluated. The interrelated effects of crack propagation and residual strength in a certain fail-safe design are discussed and the effects of material properties and structural configuration on the inspection interval are appraised. Author (ESA)

N77-29570# Royal Aircraft Establishment, Farnborough (England). Structures Dept.

A SYSTEM FOR THE AXIAL LOADING OF CREEP SPECIMENS

J. N. Webb London Aeron. Res. Council 1977 49 p refs Supersedes RAE-TR-76043; ARC-36895
(ARC-CP-1364; RAE-TR-76043; ARC-36895) Avail: NTIS HC A03/MF A01; HMSO £2.50; PHI $9.80

The problem of eccentricity of loading is considered in relation to tensile creep testing. An alignment system was developed to provide for the measurement and correction of the eccentricity of loading relative to the center line of the test specimen. The repeatability of creep test data using this system over a period of several years is reviewed. Comparison with deliberately malaligned tests indicates that axiality of loading contributes significantly to the repeatability of creep testing. Author (ESA)

N77-29571# Loughborough Univ. of Technology (England). Dept. of Transport Technology.

DEVELOPMENT OF A LARGE CURVATURE SHELL FINITE ELEMENT AND IT'S APPLICATION TO THE ANALYSIS OF AN AUTOMOTIVE STRUCTURE

H. Alaylioglu and R. Ali Apr. 1976 36 p refs
(Contract B-RG-1974-B)
(TT-7601) Avail: NTIS HC A03/MF A01

Development of the stiffness matrix for a hybrid stress shell finite element is reported. The derivation is based on Novozhilov's thin shell theory and the principle of minimum of total complementary potential. Stress functions containing different number of coefficients were investigated with a view to developing an optimum stress function which is described. Rectangular plate bending and membrane elements were also developed using the hybrid principle. A combination of these elements was used to perform static analysis of a car bodyshell and is reported. Author (ESA)

N77-29572# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Strukturmechanik.

LOWER SKIRT OF ARIANE SECOND STAGE: BUCKLING LOADS AND STRESS DISTRIBUTION IN CRITICAL REGIONS

B. Geier 11 May 1977 20 p ref
(DLR-IB-152-77/08) Avail: NTIS HC A02/MF A01

For the lower skirt of the Ariane 2nd stage some structural problems were studied using the computer program BOSOR4: the stress distribution was determined in the separation ring and in the engine thrust frame rig. Buckling loads of the structure were estimated using the linear and nonlinear capabilities of the program. Author (ESA)

N77-29573# European Space Agency, Paris (France).

PHENOMENOLOGICAL RELATIONS FOR THE PREDICTION OF LOW-CYCLE FATIGUE

Jean Lemaitre Jul. 1977 33 p refs Transl. into ENGLISH of 'Relations Phenomenologiques Utilisables pour la Prevision de la Fatigue Plastique et Visco-Plastique', ONERA, Paris Report ONERA-NT-1977-3, Mar. 1977 Original report in FRENCH previously announced as N77-25585
(ESA-TT-402; ONERA-NT-1977-3) Avail: NTIS HC A03/MF A01

The effect of structural calculations on the accuracy of prediction of fatigue rupture was indicated, and the damage concept developed in order to give a unified approach to failure. The Manson-Coffin relation, strainrange partitioning method and a model of nonlinear cumulation and interaction were established from this concept of damage and described with a view defining their range of applications. Author (ESA)

N77-29574# Naval Surface Weapons Center, White Oak, Md.

RECOMMENDED DESIGN AND ANALYSIS PROCEDURES FOR SUPPRESSIVE SHIELD STRUCTURES Final Report, 24 Dec. 1974 - 30 Sep. 1976

A. S. Kushner 16 Mar. 1977 147 p refs
(AD-A038644; NSWC/WOL/TR-76-112) Avail: NTIS HC A07/MF A01 CSCL 13/13

Structures designed as venting enclosures have been proposed to contain and suppress the explosions resulting from the accidental detonation of explosives during their manufacture, handling, and storage. These structures must provide total containment of fragments, partial suppression of the shock wave, and a controlled release of the internal quasi-static pressure. Because of the relatively low frequency of accidental detonations, the most cost effective approach to the design of such structures appears to be one utilizing inexpensive and easily erectable structures which can be replaced after an explosion. This report provides: (1) Development of a structural response model for suppressive shield structures, along with results from sample computations; (2) Results of hydrocode calculations for shock interactions with suppressive shield-type panels which provide time-dependent blast loading/transmission functions; and (3) Computed results for time-dependent internal pressure loads produced by burning propellants/pyrotechnics inside a vented enclosure. GRA

N77-29575# Drexel Univ., Philadelphia, Pa. Dept. of Mechanical Engineering and Mechanics.

ULTRASONIC PROCEDURES FOR THE DETERMINATION OF BOND STRENGTH Interim Report, Dec. 1975 - Dec. 1976

Joseph L. Rose and Jack W. Raisch Feb. 1977 53 p refs
(Grant AF-AFOSR-2480-73; AF Proj. 2307)
(AD-A038249; AFOSR-77-0372TR) Avail: NTIS HC A04/MF A01 CSCL 11/1

A completely automated ultrasonic inspection system has been developed for predicting bond strength in metal to metal adhesively bonded step-lap joints. Results to date appear promising for solving this difficult problem of predicting adhesive bond performance. A resource base developed in earlier years in experimental technology, theoretical ultrasonic wave interaction studies with adhesive bond models, manufacturing technology, and shear stress distribution analysis has been incorporated into a pattern recognition program of study. Such topics as nearest neighbor philosophy, fuzzy logic analysis, probability density, function analysis, and adaptive search and learning techniques for linear and nonlinear models are currently being investigated. Author (GRA)

N77-29576# Weidlinger Associates, New York.

ON THE UNIQUENESS AND STABILITY OF ENDOCHRONIC THEORIES OF MATERIAL BEHAVIOR Topical Report

Ivan S. Sandler Oct. 1976 26 p refs
(Contract DNA001-76-C-0127)
(AD-A038260; DNA-4133T) Avail: NTIS HC A03/MF A01 CSCL 20/11

Endochronic models represent the difference between the loading and unloading behavior of materials without employing the classical plasticity concept of a yield condition. In this report such models are shown to violate Drucker's stability postulate in the small for a cycle, and the implications of this violation are discussed. In particular, some simple problems involving endochronic models are analyzed, illustrating the difficulties which can arise when such models are used, and leading to the conclusion that they are unsuitable for the numerical solution of mechanical problems. Author (GRA)

N77-29577# Colorado State Univ., Fort Collins. Dept. of Mechanical Engineering.
THEORETICAL AND EXPERIMENTAL ANALYSIS OF SURFACE CRACKS EMANATING FROM FASTENER HOLES Final Report, 1 May 1974 - 23 Oct. 1976
F. W. Smith and T. E. Kullgren Feb. 1977 198 p refs
(Contract F33615-74-C-3069)
(AD-A039817; AFFDL-TR-76-104) Avail: NTIS HC A09/MF A01 CSCL 01/3

The finite element-alternating method is used to determine stress intensity factors along the periphery of a part-elliptical crack emanating from a fastener hole in a finite-thickness plate. The method performs a sequence of iterations between an analytic solution for an elliptical crack embedded in an infinite solid and a finite element solution for a finite-thickness uncracked plate with a fastener hole to obtain the stress field near the crack, the stress intensity factor and the crack opening displacements. Mode-one stress intensity factors around the crack front are presented for three classes of crack locations relative to the hole and numerous crack shapes and sizes. Calculations are performed for cracks emanating from both loaded and unloaded fastener holes. Crack opening displacements for all cases are presented. The results of this study are compared to static fracture tests in polymethylmethacrylate and with experiments and estimates of other authors. Author (GRA)

N77-29578# North Carolina State Univ., Raleigh. Highway Research Program.
END CRACKING IN PRESTRESSED MEMBERS DURING DETENSIONING
J. F. Mirza and M. E. Tawfik Jul. 1976 86 p Sponsored in part by N.C. Dept. of Transportation and Highway Safety, Raleigh and FHA, Raleigh, N.C.
(PB-265603/1; ERSD-110-75-6; FHWA/ERSD-110-75-6) Avail: NTIS HC A05/MF A01 CSCL 13M

Production line prestressed members were monitored for strain increase during detensioning and the castings were measured for elastic shortening. Results were compared with an analytic model capable of furnishing cable strains during any detensioning scheme in a multiple casting operation. Full scale experimental members were designed such that during transfer tensile stress in concrete due to cable restraint would be maximized. Cracks were indeed caused as predicted by analytic calculations. Finally as an example problem, full scale production line girders were monitored for cable strain during detensioning and compared with analytically calculated values. GRA

N77-29579# Watervliet Arsenal, N.Y.
PRACTICAL FRACTURE MECHANICS APPLICATIONS TO DESIGN OF HIGH PRESSURE VESSELS
Thomas E. Davidson and Joseph F. Throop Dec. 1976 49 p refs
(DA Proj. 1T1-62105-AH-84)
(AD-A036667; WVT-TR-76047) Avail: NTIS HC A03/MF A01 CSCL 20/11

Fracture mechanics provides the rationale by which thick-walled pressure vessel designs may be assessed for adequacy of material toughness, for length of fatigue life, for necessary frequency of inspection and for fatigue life remaining after the detection of a given size crack. Examples of the fatigue performance and fracture characteristics of thick-walled cylinders of high-strength steels are illustrated and interpreted with pertinent fracture mechanics calculations. These provide insight for the designer into the various aspects of metallurgical control of strength and toughness, optimization of stress state through the use of residual stresses and importance of monitoring fatigue crack propagation. Author (GRA)

N77-29580# Army Construction Engineering Research Lab., Champaign, Ill.
A PLASTICITY FORMULATION FOR CYCLIC INELASTIC STRUCTURAL ANALYSIS Interim Report
S. K. Sharma and H. R. Jhansale Feb. 1977 29 p refs
(DA Proj. 4A1-61102-AT-23)
(AD-A036473; CERL-IR-m-202) Avail: NTIS HC A03/MF A01 CSCL 20/11

A critical review of current inelastic structural analysis procedures indicates that the material constitutive models presently in use do not adequately reflect the materials' cyclic inelastic properties. This will result in an erroneous evaluation of deformation response and energy dissipation in structures subjected to dynamic loadings. This report presents a plasticity formulation which is capable of simulating all the important features of material properties observed under cyclic uniaxial loading. Appropriate cyclic material properties required for characterizing the combined isotropic-kinematic hardening features of this formulation are defined. These properties are determined from simple cyclic uniaxial tests. The formulation uses Mroz's concept of multiple and nesting hypersurfaces in stress space to simulate the memory of prior history; it eliminates the need for classifying a general loading path into a plastic loading or a plastic load reversal for cyclic analysis. The superiority of this formulation over currently available methods is demonstrated. Author (GRA)

N77-29581# Ammann and Whitney, New York.
NONLINEAR ANALYSIS OF FRAME STRUCTURES SUBJECTED TO BLAST OVERPRESSURES Final Report
William Stea, George Beng, David Kossover, Samuel Weissman, Norval Dobbs, Paul Price (Army Armament Res. and Develop. Comm., Dover, N. J.), and Joseph Caltagirone (Army Armament Res. and Develop. Comm., Dover, N. J.) May 1977 451 p
(Contract DAAA21-76-C-0125)
(AD-A040708; ARLCD-CR-77008) Avail: NTIS HC A20/MF A01 CSCL 19/4

In modern day explosive manufacturing and LAP facilities, many of the structural steel buildings will be required to provide protection for personnel and/or equipment against the effects of HE-type explosions. Therefore, computer program entitled 'Dynamic Nonlinear Frame Analysis' (DYNFA) has been developed whereby the responses of frame structures subjected to blast loadings can be determined. This report contains the background for the development of DYNFA as well as the equations and procedures necessary for its use. The report also contains example problems illustrating the use of DYNFA for the design of blast-resistant frame structure. Author (GRA)

N77-29582# Waterloo Univ. (Ontario). Dept. of Civil Engineering.
STUDIES ON BASIC MECHANISMS OF STRUCTURAL FATIGUE Final Report
T. H. Topper and J. F. Martin Sep. 1976 24 p
(Grant AF-AFOSR-2757-75)
(AD-A036568; AFOSR-77-0110TR) Avail: NTIS HC A02/MF A01 CSCL 11/6

Cumulative damage procedures based on a local stress-strain approach which includes an adequate description of metal processing, plastic deformation history and resulting residual stresses, can adequately predict fatigue for uniaxial stress at temperatures where metal deformation is time dependent. The extension of these procedures to biaxial stressing and elevated temperatures is possible for limited cases but much remains to be done before general applicability is possible. Models for reversed plastic deformation capable of describing structural plasticity have been successfully applied to several metals and geometries. Load history characterization by generalized models is on the other hand applicable only in a few restricted cases. GRA

N77-29583# California Univ., San Diego. Dept. of Applied Mechanics and Engineering Sciences.
A RAYLEIGH-RITZ DETERMINATION OF UPPER AND LOWER BOUNDS FOR THE DEFLECTION OF ORTHOTROPIC CANTILEVER BEAMS
S. Nair Apr. 1977 17 p refs
(Contract N00014-75-C-0158)
(AD-A040324) Avail: NTIS HC A02/MF A01 CSCL 13/13

A numerical scheme based on polynomial approximation is presented for the calculation of upper and lower bounds for the flexibility coefficient of end-loaded orthotropic cantilever beams in a state of plane stress, through use of the principles of minimum potential energy and of minimum complementary energy. The degree-of-freedom of the two-dimensional polynomials employed along with the elastic constants and the depth-to-span ratio of the beam are external parameters of the problem. Author (GRA)

N77-29584# Massachusetts Univ., Amherst. Dept. of Civil Engineering.
RESPONSE OF STRUCTURES TO RANDOM NOISE Final Report, 1 Aug. 1972 - 31 Oct. 1976
William A. Nash Nov. 1976 82 p refs
(Grant AF-AFOSR-2340-72)
(AD-A040513; AFOSR-77-0696TR) Avail: NTIS HC A05/MF A01 CSCL 13/13

The work reported here has been directed along three main avenues. First, a new method has been developed for determination of natural frequencies and associated mode shapes of thin elastic plates and also shallow shells undergoing free, undamped vibration. The method permits consideration of arbitrary boundary conditions along each side of a polygonal plate or polygonal plan-form shell and further offers a comprehensive evaluation of how well the boundary conditions have been satisfied along each edge. Second, the structural reliability of geometrically nonlinear structures subject to stationary random excitation has been investigated by two approaches which have been found to yield satisfactory predictions of reliability. Third, a technique has been developed for prediction of the statistical characteristics of the response of a nonlinear system to nonstationary random excitation. Author (GRA)

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N77-29585 California Univ., Los Angeles.
THE ORTHOPHOTO AND ORTHOPHOTOMAP: CHARACTERISTICS, DEVELOPMENT AND ASPECTS OF CARTOGRAPHIC COMMUNICATION Ph.D. Thesis
Johnny Russell Jensen 1976 176 p
Avail: Univ. Microfilms Order No. 77-7673

Controlled experiments were developed to determine if there is a statistically significant difference in the ability of map readers to extract the following types of information from large scale photogrammetric linemaps versus large scale orthophotomaps: (1) tabular and integrative data, (2) magnitude estimation of horizontal distance, (3) magnitude estimation of rectangular area; and (4) magnitude estimation of polygon area. Independent variables examined in this study include: (1) map type (planimetric linemap, orthophotomap, inverted-pseudoscopic orthophotomap), (2) map reader background (laymen, cartographer, photointerpreter), (3) map scale (1:2000, 1:4000, 1:8000), landscale (Urban, suburban, rural); and (4) map reader confidence and preference. Dissert. Abstr.

N77-29586 Purdue Univ., Lafayette, Ind.
SURFACE AND STRUCTURAL PROPERTIES OF PALYGORSKITE Ph.D. Thesis
George Emerson VanScoyoc 1976 94 p
Avail: Univ. Microfilms Order No. 77-7544

Infrared spectra of the coordinated water in palygorskite were studied at different degrees of exchange of deuterons and protons. The single peaks observed for the bending fundamental of isotopically diluted H2O and D2O show that all the coordinated water molecules are equivalent, as suggested by Bradley's structure determination. Response of palygorskite films to the angle of orientation indicated one of the OH stretching modes to have its transition moment nearly perpendicular to the [100] plane. The orientation effect results from one of the protons on each of the coordinated water molecules forming a hydrogen bond directed towards the hexagonal holes of oxygens formed by the Si-O-Si connections between the amphibole chains, and it explains the distorted character of this water. Dissert. Abstr.

N77-29587 Cornell Univ., Ithaca, N.Y.
THE DETERMINATION OF REGIONAL EVAPOTRANSPIRATION USING REGULARLY RECORDED DATA AND THE BOUNDARY LAYER TRANSFER COEFFICIENTS Ph.D. Thesis
John Anthony Mawdsley 1976 158 p
Avail: Univ. Microfilms Order No. 77-8363

A procedure to determine the evapotranspiration from a region even when the water supply to the surface may be limiting, using only regularly recorded meteorological data, is presented. It was applied at one location in the U.S.A. for four years; the results are presented and compared with other, independently obtained, evapotranspiration data. Most other currently used methods for determining evapotranspiration either require special instrumentation to be installed at the site, or are empirical and have no firm physical base. The formulation is derived from general similarity arguments applied to the two sublayers of the atmospheric boundary layer, the surface layer and the outer layer, coupled with the assumption that a matched layer exists where the profiles are valid simultaneously. The formulation is expressed in the form of a Dalton equation with a boundary layer transfer coefficient. Dissert. Abstr.

N77-29588 Colorado State Univ., Fort Collins.
A PHYSICALLY-BASED APPROACH TO WATERSHED PARTITIONING Ph.D. Thesis
Norman Earl Spangenberg 1976 93 p
Avail: Univ. Microfilms Order No. 77-6814

The hypothesis that physically-based hydrologic yield units in a basin can estimate yield better than larger units based on simpler criteria was tested in a mountain watershed in Eastern Oregon. Physically-based units were identified on the basis of soil type, vegetative cover, aspect and slope. The larger, simpler units tested were precipitation-based units with boundaries defined by the limits of precipitation influence zones, and temperature-based units with boundaries defined by temperature zones in the basin. The total basin was also evaluated as a simple yield unit. A water balance was applied to each unit, and unit yields were added together. The summed unit yields were routed through a storage and flood routing program to obtain basin yield. Yields were calculated on a daily basis and added to give 10-day total flow and monthly total flow values. Daily, 10-day and monthly yields were compared with measured yields using regression analysis and direct graphical comparison to determine the accuracy of the calculated results. Dissert. Abstr.

N77-29589 Utah State Univ., Logan.
AN APPROACH TO THE SIMPLIFICATION OF WATERSHED MODELS FOR APPLICATIONS PURPOSES Ph.D. Thesis
Donald L. Chery, Jr. 1976 207 p
Avail: Univ. Microfilms Order No. 77-8464

Modeling of surface water flow in a watershed was reviewed. The nonlinear kinematic model was accepted as one of the best physically-based representations of the surface-channel flow system. A computer program was written that combined the reviewed flow solutions with a recent infiltration model to give a model with infiltrating planes and channels. Flow from triangular planes and a channel with distributed lateral inflow were innovations in the program. Since the kinematic model is related to the physical properties of a watershed, it may be used to make predictions for an ungaged area, assuming acceptable fitting of model parameters to geometry, roughness and soil properties in the real system. Dissert. Abstr.

N77-29590 California Univ., San Diego.
THE DISTRIBUTION, MINERALOGY, AND PETROGRAPHY OF BIOGENIC AND AUTHIGENIC SILICA FROM THE PACIFIC BASIN Ph.D. Thesis
John Bodley Keene 1976 286 p
Avail: Univ. Microfilms Order No. 77-8725

The distribution of chert and other siliceous rocks in the Pacific Basin can be explained by the presence, or former presence of biogenic silica. Volcanism is not necessary, either as a direct or an indirect source of silica. An equatorial belt of high productivity

in the surface water existed in the Cenozoic; the northward movement of the Pacific Plate beneath this belt is recorded as biogenic and authigenic silica. Authigenic silica has been sampled in Miocene and older sediments. The middle Eocene chert is the result of diagenesis, and need not be explained by a change in the silica budget. It takes up to 50 million years for authigenic silica to form in a clayey siliceous ooze with no carbonate. Dissert. Abstr.

N77-29591*+ National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT NON-US STANDARD CATALOG, 1 APRIL 1977 THROUGH 30 APRIL 1977
30 Apr. 1977 146 p
(NASA-TM-74828; GSFC/LN-C/004; NTISUB/C/139-004) Avail: NTIS HC A07 CSCL 05B

The Non-U.S. Standard Catalog lists imagery acquired by LANDSAT 1 and 2 which has been processed and input to the data files during the referenced month. Data, such as date acquired, cloud cover and image quality are given for each scene. The microfilm roll and frame on which the scene may be found is also given. Author

N77-29592 Cornell Univ., Ithaca, N.Y.
PHOTO-GEOLOGY AND REMOTE SENSING SYSTEMS FOR LOCATING ORE DEPOSITS Ph.D. Thesis
Linda Susan Zall 1976 227 p
Avail: Univ. Microfilms Order No. 77-8419

The geologic nature of the more economically significant ore deposits, summaries of their occurrence, and applied photo-geology and remote sensing techniques of mineral exploration in a known mineralized test area were investigated. Photo-geology was utilized to investigate the bedrock and structural geology of the Zacatecas district, Zacatecas, Mexico, where mineralization occurs as epithermal vein deposits in Tertiary acidic volcanics. Significant radial and peripheral fracture patterns, thought to be related to caldera collapse, were identified and delineated on 1:25,000 scale black-and-white stereo aerial photographs and subjected to a detailed analysis. The known mines were found to be related to favorable structures and lithologies located on or near to major fracture zones or fracture intersections, related to the radial-peripheral patterns. Dissert. Abstr.

N77-29593*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT NON-US STANDARD CATALOG, 1 MAY 1977 - 31 MAY 1977
31 May 1977 113 p
(NASA-TM-74825; GSFC/LN-C/005; NTISUB/C/139-005) Avail: NTIS HC A06/MF A01 CSCL 05A

Information regarding the availability of LANDSAT imagery processed and input to the data files by the NASA Data Processing Facility is published on a monthly basis. The U.S. Standard Catalog includes imagery covering the continental United States, Alaska and Hawaii. the Non-U.S. Standard Catalog identifies all the remaining coverage. Sections 1 and 2 describe the contents and format for the catalogs and associated microfilm. Section 3 provides a cross-reference defining the beginning and ending dates for LANDSAT cycles. Sections 4 and 5 cover LANDSAT-1 and LANDSAT-2 coverage, respectively. Author

N77-29594*# General Electric Co., Beltsville, Md. LANDSAT Operations Control Center.
LANDSAT-1 AND LANDSAT-2 FLIGHT EVALUATION REPORT, 23 OCTOBER 1976 TO 23 JANUARY 1977
22 Feb. 1977 232 p refs
(Contract NAS5-21808)
(NASA-CR-152577; Rept-77SDS4204) Avail: NTIS HC A11/MF A01 CSCL 22A

Performance analyses for LANDSAT 1 and 2, launched respectively in 1972 and 1975, are reported. Operational controls are evaluated, as well as orbital parameters and various subsystems. Both satellites continue to perform their missions normally, in spite of past minor operational malfunctions. B.L.P.

N77-29595# Centre National d'Etudes Spatiales, Toulouse (France).
IDENTIFICATION OF NETWORKS IN SPACE GEODESY BY SHORT ORBITAL ARCS (SHORT-ARC METHOD) [IDENTIFICATION DE RESEAUX EN GEODESIE SPATIALE PAR UTILISATION D'UNE TECHNIQUE D'ARCS ORBITAUX COURTS (METHODE SHORT-ARC)]
Jean Pierre Carrou Dec. 1976 35 p refs In FRENCH; ENGLISH summary
(CNES-NT-61) Avail: NTIS HC A03/MF A01

The short-arc method provides a means of obtaining geodetic networks by use of satellite-to-station measurements. The accuracy of the method depends on a good estimate of orbital perturbations. Local arcs of the orbit are adjusted to reduce perturbations effects. The station positions and the orbital parameters of each arc are adjusted simultaneously. The associated software as well as the first results obtained using simulated data are discussed. Author (ESA)

N77-29596# Centre National d'Etudes Spatiales, Toulouse (France).
DETERMINATION OF THE GEOLE POLYHEDRON BY THE SHORT-ARC METHOD [OBTENTION DU POLYEDRE GEOLE PAR LA METHODE SHORT-ARC]
Jean-Pierre Carrou Jan. 1977 18 p In FRENCH; ENGLISH summary
(CNES-NT-65) Avail: NTIS HC A02/MF A01

The first phase of the Geole system is to establish a world reference system by means of a basic polyhedron with a station at each apex. Until now, this polyhedron was obtained by using a geometrical mode of treatment requiring a satellite altitude of 4000 km and a network of 36 stations. The short arc method was experimented and it has been found that with some assumptions on accuracy of earth model potential it is possible to obtain such a polyhedron with only 10 stations and a satellite altitude of 1500 km which is compatible with the possibilities of the European launcher Ariane. Author (ESA)

N77-29597# Federal Energy Administration, Washington, D. C. Strategic Petroleum Reserve Office.
STRATEGIC PETROLEUM RESERVE. SUPPLEMENT FINAL ENVIRONMENTAL IMPACT STATEMENT. WEST HACKBERRY SALT DOME
Apr. 1977 350 p refs
(PB-265796/3; FEA/S-77/114-Suppl; FES-76/77-4-Suppl) Avail: NTIS HC A15/MF A01 CSCL 21D

The system assessed involves construction of a temporary surface pipeline from the site to the Amoco dock and use of the dock for interim fill, and construction of a permanent buried pipeline from the site to the Sun Terminal. This report assesses the environmental impacts caused by the construction and operation of the new components of the system. GRA

N77-29598# TRW, Inc., McLean, Va. Energy Systems Planning Div.
THE STRATEGIC PETROLEUM RESERVE AND LIQUEFIED NATURAL GAS SUPPLIES Final Report
R. J. Fink, B. A. Bancroft, and T. M. Palmieri 15 Feb. 1977 83 p
(Contract FEA-CR-04-60918-00)
(PB-265488/7; FEA/S-77/123) Avail: NTIS HC A05/MF A01 CSCL 21D

The impact which would be caused by an LNG embargo alone and a simultaneous LNG and oil embargo is analyzed. GRA

N77-29599# Environmental Systems Research Inst., Redlands, Calif.
DIMECNV: A SYSTEM FOR CONVERTING SCANNER-DIGITIZED MAPPING DATA TAPES TO POLYGON FORMAT
20 Dec. 1976 35 p Sponsored in part by Geol. Survey, Reston, Va.
(PB-266438/1) Avail: NTIS HC A03/MF A01 CSCL 08B

Land use maps, correlative census and county boundary maps, drainage basin maps, and geologic maps were produced. To demonstrate the system's capability, color transparencies and black-and-white printouts of the Montgomery County, Maryland and Fairfax County, Virginia land use maps were produced by playing the digitized data through plotting devices. Documenta-

tion of the computer conversion program is provided with this project. GRA

N77-29600# Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.
TEMPERATURE PATTERNS IN AN ALPINE SNOW COVER AND THEIR INFLUENCE ON SNOW METAMORPHISM Technical Report, Nov. 1974 - Nov. 1976
Edward R. LaChapelle Feb. 1977 42 p refs
(Grants DAHC04-75-G-0028; DAAG29-76-G-0088)
(AD-A040169) Avail: NTIS HC A03/MF A01 CSCL 08/12

Spatial and temporal variations of temperature in alpine snow covers have been systematically observed over a period of two winters. Concurrently, snow crystal metamorphism has been monitored in the same snow covers, along with such basic snow properties as density and ram resistance. Near-surface snow temperatures fluctuate widely in response to diurnal weather variations. Below about 25 cm beneath the surface the temperatures change more slowly in response to longer-term weather trends. Mean snow temperatures are colder on north slopes than south ones but mean snow cover temperature gradients are similar on both exposures owing to shallower snow on south slopes. A forest canopy tends to suppress snow surface radiation cooling and hence reduce magnitude of temperature gradients at depth. Metamorphism in snow follows a recrystallization mode with declining mechanical strength when the saturation water vapor pressure gradient exceeds 0.05 mb/cm. Owing to a nonlinear vapor pressure-temperature relationship over ice, this corresponds to the conventional critical temperature gradient of 0.1 C/cm for this metamorphism mode only at snow temperatures close to the melting point. Mean monthly snow temperature gradients can reasonably be estimated from air temperature and snow depth means, but this method can be extended to vapor pressure gradients only if appropriate corrections for non-linearity are introduced. Author (GRA)

N77-29601*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT US STANDARD CATALOG, 1 APRIL 1977 - 30 APRIL 1977
30 Apr. 1977 97 p
(NASA-TM-74776; GSFC/LU-C/004; NTISUB/C/138-004) Avail: NTIS HC A05/MF A01 CSCL 05B

The U.S. Standard Catalog lists U.S. imagery acquired by LANDSAT 1 and 2 which has been processed and input to the data files during the referenced month. Data, such as date acquired, cloud cover, and image quality are given for each scene. The microfilm roll and frame on which the scene may be found is also given. Author

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N77-29602 Purdue Univ., Lafayette, Ind.
APPLICATIONS OF A DOUBLY-FED INDUCTION MACHINE IN A LARGE FLYWHEEL ENERGY STORAGE SYSTEM Ph.D. Thesis
Kongkun Hemmaplardh 1976 115 p
Avail: Univ. Microfilms Order No. 77-7466

A doubly-feed induction machine is analyzed. The power and torque expressions are obtained. By introducing a change in the machine parameter, the possibility of constant power operation of the machine over a wide speed range is established. Steady state stability of the machine is investigated. Steady state operation of the machine over a wide speed range with no additional control involves a region of instability. Dissert. Abstr.

N77-29603*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TERRESTRIAL PHOTOVOLTAIC MEASUREMENT PROCEDURES
Jun. 1977 18 p refs
(Contract E(49-26)-1022)
(NASA-TM-73702; ERDA/NASA-1022-77/16; E-8421-1) Avail: NTIS HC A02/MF A01 CSCL 10A

Procedures for obtaining cell and array current-voltage measurements both outdoors in natural sunlight and indoors in simulated sunlight are presented. A description of the necessary apparatus and equipment is given for the calibration and use of reference solar cells. Some comments relating to concentration cell measurements, and a revised terrestrial solar spectrum for use in theoretical calculations, are included. Author

N77-29604*# Spectrolab, Inc., Sylmar, Calif.
DEVELOPMENT OF STANDARDIZED SPECIFICATIONS FOR SILICON SOLAR CELLS Final Contractor Report
John A. Scott-Monck Aug. 1977 83 p refs
(Contract NAS3-19440)
(NASA-CR-135233; Rept-380-6240) Avail: NTIS HC A05/MF A01 CSCL 10A

A space silicon solar cell assembly (cell and coverglass) specification aimed at standardizing the diverse requirements of current cell or assembly specifications was developed. This specification was designed to minimize both the procurement and manufacturing costs for space qualified silicon solar cell assemblies. In addition, an impact analysis estimating the technological and economic effects of employing a standardized space silicon solar cell assembly was performed. Author

N77-29605# Committee on Science and Technology (U. S. House).
POLAR ENERGY RESOURCES POTENTIAL
Washington GPO 1976 192 p refs Rept. for Subcomm. on Energy Res., Development and Demonstration and the Subcomm. on Energy Res., Development and Demonstration Fossil Fuels of the Comm. on Sci and Technol., 94th Congr., 2d Sess., Sep. 1976 Prepared by Library of Congr., Congressional Res. Service
(GPO-76-187) Avail: Subcomm. on Energy Res., Development and Demonstration

Of the vast known resources contained in the Arctic, only the oil and gas deposits are undergoing, and are expected to continue to undergo, large scale exploitation. This activity will provide incentives for continued development and refinement of polar oil and gas exploration, production, and transportation technology. Other polar energy resources such as coal, hydropower, uranium, and geothermal energy while often present in enormous quantity will be utilized only locally and on a small scale. Ultimate utilization of polar energy resources will be determined by the economic and energy supply conditions in temperate areas and by the degree of success of the technological advancement needed to develop resources in such remote and inhospitable regions. Author

N77-29606*# Ball State Univ., Muncie, Ind. Dept. of Physics and Astronomy.
THE LINEAR FRESNEL LENS SOLAR CONCENTRATOR: TRANSVERSE TRACKING ERROR EFFECTS
Robert M. Cosby Washington Aug. 1977 55 p refs
(Contract NCA8-00121)
(NASA-CR-2889; M-228) Avail: NTIS HC A04/MF A01 CSCL 10A

The solar concentration performance of a line focusing, flat base Fresnel lens in the presence of small transverse tracking errors was analyzed. Solar transmittance of the lens and focal plane imaging characteristics were evaluated. Transmission losses by reflectance and material absorption were also studied. Author

N77-29607*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF REGENERATED SINGLE-SHAFT CERAMIC GAS-TURBINE ENGINES AND RESULTING FUEL ECON-

OMY IN A COMPACT CAR
John L. Klann and Roy C. Tew, Jr. Washington Aug. 1977 23 p refs
(NASA-TM-X-3531; E-9103) Avail: NTIS HC A02/MF A01 CSCL 10B

Ranges in design and off-design operating conditions of an advanced gas turbine and their effects on fuel economy were analyzed. The assumed engine incorporated a single stage radial flow turbine and compressor with fixed geometry. Fuel economies were calculated over the composite driving cycle with gasoline as the fuel. At a constant turbine-inlet temperature, with a regenerator sized for a full power effectiveness the best fuel economies ranged from 11.1 to 10.2 km/liter (26.2 to 22.5 mpg) for full power turbine tip speeds of 770 to 488m/sec (2530 to 1600ft/sec), respectively. Author

N77-29608# Hittman Associates, Inc., Columbia, Md.
ENERGY UTILIZATION INDEX METHOD FOR PREDICTING BUILDING ENERGY USE. VOLUME 2: PROPOSED SUPPLEMENT TO TB ENG 529 Interim Report
L. M. Windingland, Barry K. Hinkle, and James E. Piper May 1977 165 p refs 2 Vol.
(Contract DACA23-76-C-0001; DA Proj. 4A7-62719-AT-41) (AD-A040344; CERL-IR-E-105-Vol-2) Avail: NTIS HC A08/MF A01 CSCL 13/13

This report describes development of the Energy Utilization Index (EUI) method for manually calculating monthly and annual energy consumption for buildings on military installations. The method uses basic building parameters such as U-factors, dimensions, occupancy, type of HVAC equipment, and average monthly weather conditions to arrive at a prediction for a building's monthly and annual energy use. Procedures for aggregating individual building consumption data into facility and installation consumption predictions are provided. The method for correcting the predictions to account for actual weather conditions is also described. GRA

N77-29609# Battelle Pacific Northwest Labs., Richland, Wash.
MODELING AND OPTIMIZATION OF GEOTHERMAL POWER PLANTS USING THE BINARY FLUID CYCLE
R. A. Walter Sep. 1976 148 p refs
(Contract E(45-1)-1830)
(BNWL-2112) Avail: NTIS HC A07/MF A01

A computer simulation of a binary fluid cycle power plant for use with geothermal energy sources, and the subsequent optimization of this power plant type over a range of geothermal source conditions are described. The optimization technique employed for this analysis was based upon the principle of maximum use of geothermal energy. ERA

N77-29610# Grumman Aerospace Corp., Bethpage, N.Y. Fluid Dynamics Lab.
DIFFUSER AUGMENTATION OF WIND TURBINES
K. M. Foreman, B. Gilbert, and R. A. Oman 1976 13 p refs Presented at the Joint Conf. of the Am. Sect. of the Intern. Solar Energy Soc. and the Solar Energy Soc. of Canada, Inc., Winnipeg, Canada, 15 Aug. 1976
(Contract E(11-1)-2616)
(CONF-760842-6) Avail: NTIS HC A02/MF A01

Wind tunnel investigation of models of two diffuser design concepts is directed toward unconventional, very short, cost-effective configurations. One approach uses the energetic external wind to prevent separation of the diffuser's internal boundary layer. Another method used high lift airfoil contours for the diffuser wall shape. Diffuser model tests have indicated almost a doubling of wind power extraction capability for DAWTs compared to conventional turbines. Economic studies of DAWTs have used these test data and recent (1975) cost projections of wind turbines with diameter. ERA

N77-29611# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
INTERNAL HEAT TRANSFER EXPERIMENTS IN A SIMULATED OTEC EVAPORATOR TUBE
H. L. Olsen, P. P. Pandolfini, and J. L. Rice Nov. 1976 68 p refs
(Contracts E(49-26)-1030; N00017-72-C-4401)
(APL/JHU/AEO-76-066) Avail: NTIS HC A04/MF A01

Internal heat transfer tests have been conducted for ammonia in two phase flow inside a nearly horizontal aluminum tube. This tube simulates one pass of a multipass evaporator tube for use in a low cost ocean thermal energy conversion plant-ship concept. The tests covered mass flows, heat fluxes, qualities up to 20% vapor by mass, and tube angles. Stratified, wavy or intermittent flow occurred in all tests. The results indicate that overall internal heat transfer coefficients essentially equivalent to the prior predictions for this heat exchanger concept are obtained in evaporators using horizontal tubes. ERA

N77-29612# Sandia Labs., Albuquerque, N. Mex.
APPLICATION OF LAMINATED WOODEN BLADES TO A TWO-METER DARRIEUS TYPE VERTICAL AXIS WIND TURBINE
B. L. Butler and Bonnie F. Blackwell Dec. 1976 21 p refs
(Contract E(29-1)-789)
(SAND-75-0284) Avail: NTIS HC A02/MF A01

The use of laminated Lauan plywood in a 2-meter-diameter, 3-bladed Darrieus wind turbine is described. The manufacture, testing and tensile stress analysis of laminated wooden blades are described. The thin NACA 0012 blade was excited into resonance well below the peak power rpm and constrained the turbine to low power output. The 2-meter wind turbine model tests indicated that, with appropriate blade design, wood has potential for small vertical axis wind turbines. ERA

N77-29613# Sandia Labs., Albuquerque, N. Mex.
SANDIA VERTICAL-AXIS WIND TURBINE PROJECT Technical Quarterly Report, 1 Apr. - 30 Jun. 1976
R. C. Reuter, Jr., ed. and Robert E. Sheldahl, ed. Jan. 1977 78 p refs
(Contract E(29-1)-789)
(SAND-76-0581) Avail: NTIS HC A05/MF A01

Highlights for the quarter and status reports on activities in areas of systems studies aerodynamics, electrical systems, structures, and mechanical design are presented. Subheadings in each section cover general development activities and activities related to the 17-meter turbine and the 5-meter turbine. ERA

N77-29614# Southern California Gas Co., Los Angeles.
PROJECT SAGE: SOLAR ASSISTED GAS ENERGY PROJECT. UNITED STATES SPECIAL FORMAT REPORT
Aug. 1976 84 p refs Sponsored by ERDA
(DSE/4691-76/1) Avail: NTIS HC A05/MF A01

The purpose is to give a preliminary description of Project SAGE, the solar assisted gas energy (SAGE) water heating system currently being tested and evaluated in Southern California. A statement of the goals and objectives of the SAGE water heating program, a general description of the project in addition to system performance data, evaluations and economic analyses of the various pilot studies, and field test installations are reported. ERA

N77-29615# Brookhaven National Lab., Upton, N. Y.
ENERGETICS OF THE UNITED STATES OF AMERICA: AN ATLAS
F. R. Drysdale and C. E. Calef Sep. 1976 444 p
(Contract EY-76-C-02-0016)
(BNL-50501) Avail: NTIS HC A19/MF A01

A description of the United States' energy system is presented in the form of thirty-one maps and eight major tables. The county has been chosen as the basic unit for reporting estimations of many energy, demographic, and economic variables. The variables include production of all fuels (including hydroelectricity), use of fuels and electricity broken down by sector and end use, existing and planned electricity generation capacity, refinery capacities, and emissions of air pollutants from fuel use. Calculations and assumptions used to make county-level energy estimates are described in detail. ERA

N77-29616# California Univ., Livermore. Lawrence Livermore Lab.
OPTIMAL DESIGN OF ANISOTROPIC (FIBER-REINFORCED) FLYWHEELS
R. M. Christensen and E. M. Wu 2 Nov. 1976 16 p refs
(Contract W-7405-eng-48)
(UCRL-52169) Avail: NTIS HC A02/MF A01

An analysis is given of the kinetic energy storage capacity of anisotropic flywheels. Using a uniform strain failure criteria, the optimal shapes of flywheels are determined as a function of the degree of anisotropy. Within this spectrum of shapes, practical design considerations are shown to favor the case where there is equal reinforcement in the radial and circumferential directions. Comparisons are made between the present solid-wheel-type design and the ring design and also between candidate materials. ERA

N77-29617# California Univ., Livermore. Lawrence Livermore Lab.
MECHANICAL ENGINEERING DEPARTMENT Quarterly Report, Jul. - Sep. 1976
R. G. Stone, ed. and M. B. Bathgate, ed. 30 Sep. 1976 41 p refs
(Contract W-7405-eng-48)
(UCRL-50016-76-3) Avail: NTIS HC A03/MF A01

Holographic interferometry, electron beam welding, tritium facility design, ground motion, and calculus of vapor flow are studied. A separate abstract was prepared for each of the sections. ERA

N77-29618# Princeton Univ., N. J.
NOVEL ENERGY SOURCES BASED ON UTILIZATION OF CATALYSTS IN ATOMIC ENERGY Progress Report, 1 Jun. 1975 - 15 May 1976
J. Turkevich May 1976 15 p refs
(Contract E(11-1)-3029)
(COO-3029-15) Avail: NTIS HC A02/MF A01

A program of conserving energy by more efficient use of catalysts and developing novel sources of energy consisted in the preparation for this purpose of monodisperse platinum, palladium, platinum-gold and platinum-palladium alloys in colloidal aqueous solution. It was shown that for particles down to 19A diameter the platinum had metallic character and all surface sites had equal catalytic activity. In the case of palladium the activity per site was four times that of platinum. The allowance of small amounts of gold increased the activity of the platinum or endowed catalytic activity to gold. Storage of hydrogen atoms (generated in the gas phase) in the fluoride lattice of calcium fluoride was investigated as a novel form of energy storage. ERA

N77-29619# Wormser Scientific Corp., Stamford, Conn.
SOLAR HOUSE HEATING SYSTEM USING REFLECTIVE PYRAMID OPTICAL CONDENSING SYSTEM Progress Report, 1 Jun. 1975 - 1 Jun. 1976
Jul. 1976 48 p
(Contract E(11-1)-2769)
(COO-2769-4; WSC-101-4; PR-101-4) Avail: NTIS HC A03/MF A01

The effectiveness of pyramidal optics for concentrating solar energy in the heating and cooling system of a newly constructed house is assessed. The installation, instrumentation, and operation of the self-adjusting panel is described. ERA

N77-29620# Maschinenfabrik Augsburg-Nuernberg A.G., Munich (West Germany).
ENERGY ACCUMULATION THROUGH STATIONARY FLYWEEL SYSTEMS Final Report
Otto Brandstaedter Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1976 205 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-76-58) Avail: NTIS HC A10/MF A01; ZLDI, Munich DM 42.90

General conditions for the economic use of stationary (large scale) flywheel plants were investigated. Problems of construction and technical use were clarified. It appears that a storage capacity of up to 10 MWh per unit may be achieved. Possibilities for application exist for bulk-customers and railways. The economics and financial effectiveness of a storage unit of a virtual test plant with less than 1 MWh storage capacity is demonstrated. The most important result, according to the state of the art, is that only the flywheel offers the possibility to store electrical energy that is consumer oriented instead of oriented only to power-plants. Author (ESA)

N77-29621# Naval Surface Weapons Center, White Oak, Md.
DEVELOPMENT OF AN IMPROVED SEPARATOR MATERIAL FOR ALKALINE SILVER-ZINC BATTERIES Technical Report, Dec. 1975 - May 1976
W. P. Kilroy and James V. Duffy 1 Feb. 1977 25 p refs
(SF43431302)
(AD-A038754; NSWC/WOL/TR-76-135) Avail: NTIS HC A02/MF A01 CSCL 07/3

This work was a preliminary investigation to determine if polyphenylquinoxaline (PPQ) or a codispersed mixture of polyvinylpyrrolidone (PVP) with PPQ could be used to replace cellophane as a separator in the zinc-silver oxide battery. The primary purpose was to compare its dimensional and chemical stability with cellophane and to determine if methods could be developed to lower its high inherent electrical resistance. Dimensional measurements were made in 45% KOH at 298 K (25 C) and 353 K (80 C). Chemical stability to oxidation was observed in KOH solution saturated with silver oxide at 353 K. In an effort to lower the resistance of these thin film membranes, various methods were studied to develop porosity. Included among these were extraction of the PVP in boiling water, pyrolysis of the PVP, swelling of the films with phenol, and precipitation of the PPQ from acetone. Increasing the molecular weight of the PVP appears very promising, and additional studies are recommended since these polymers have good potential use as separators. Author (GRA)

N77-29622# Mallory (P. R.) and Co., Inc., Burlington, Mass. Lab. for Physical Science.
SEALED PRIMARY LITHIUM-INORGANIC ELECTROLYTE CELL Quarterly Report, 1 Dec. 1976 - 28 Feb. 1977
A. N. Dey May 1977 53 p
(Contract DAAB07-74-C-0109)
(AD-A039884; ECOM-74-0109-12; QR-12) Avail: NTIS HC A04/MF A01 CSCL 10/3

The Li/SOCl2 hermetic D cell developed by P. R. Mallory and Co., Inc. met or exceeded all the initial objectives of an E. D. of 150 W-hr/lb at the thirty-hour rate and a peak power density of 50 watts/lb and the storage and operating temperatures of -40 to 160 F. However, the cells showed severe voltage-delays at -30 C after storage at 72 C, particularly at high rates. This problem was investigated in detail and several methods were given for alleviating this problem. The lowering of the salt concentration in the electrolyte from 1.8(M) to 0.5(M) LiAlCl4-SOCl2 appeared to be an effective way to alleviate the voltage-delay problem. This also resulted in an increase in the intrinsic energy density of the cell. GRA

N77-29623# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
ENERGY PROGRAMS AT THE JOHNS HOPKINS UNIVERSITY APPLIED PHYSICS LABORATORY Quarterly Report, Oct. - Dec. 1976
Dec. 1976 37 p refs Sponsored by ERDA
(Contract N00017-72-C-4401)
(AD-A038096; APL/JHU/EQR/76-4) Avail: NTIS HC A03/MF A01 CSCL 10/1

This volume contains a record of the activities of the Applied Physics Laboratory in the development of energy sources and energy storage methods. The larger number of articles describe APL activities that assist the Planning Office of the Division of Geothermal Energy (DGE) of ERDA. Efforts in this field are concentrated on resource assessment and utilization in DGE Region 5 (the states east of the Rocky Mountains, excluding Texas and Louisiana). The other sections describe three efforts: (1) design of a Community Annual Storage Energy System, (2) developmental work on polycrystalline silicon solar cells, and (3) design and experimental work on a system to use ocean thermal energy. Author (GRA)

N77-29624# Tetra Tech, Inc., Arlington, Va.
ENERGY FACT BOOK, 1977
Apr. 1977 437 p refs Supersedes TETRAT-A-642-76-254
(Contract N00014-76-C-0239)
(AD-A038802; TETRAT-A-642-77-306) Avail: NTIS HC A19/MF A01 CSCL 10/1

The Energy Fact Book-1977 summarizes the present U. S. Energy situation; Energy R and D Legislation; Federal Government

Energy R and D; and International Energy R and D. It includes a brief description of the various processes and developments related to hydrocarbon fuels, synthetic fuels, non-hydrocarbon energy sources and energy conservation. Author (GRA)

N77-29625# State Univ. of New York at Buffalo, Amherst. Dept. of Electrical Engineering.
HIGH POWER STUDY - POWER CONDITIONING Final Report, Jun. 1975 - Jan. 1976
A. S. Gilmour, Jr. Wright-Patterson AFB, Ohio AFAPL Jan. 1976 174 p refs
(Contract F30602-75-C-0122; AF Proj. 3145)
(AD-A038724; AFAPL-TR-76-101) Avail: NTIS HC A08/MF A01 CSCL 10/2

This paper summarizes the power conditioning portion of the high power study that was performed for the Air Force Aero-Propulsion Laboratory by the State University of New York at Buffalo. This effort defines the power conditioning system and critical component developments which will be required to interface the airborne 10 MW to 50 MW sources defined under separate study efforts with certain loads. Power conditioning systems are considered for use with magnetohydrodynamic generators and turbine driven alternators, both conventional and superconducting. The critical components required for each of the power conditioning systems are identified and then analyzed. The component analyses include estimations of development efforts necessary and of specific weights and volumes of components. The primary components considered are transformers (for alternator as well as for inverter use), switches, capacitors and inductors. Weight algorithms are developed for each of the components. Following the component analyses, subsystems such as inverters and rectifier and filter packages are considered. The data for the various components and subsystems are then utilized for a comparison of the power conditioning techniques to be used with the various power sources. The weights and volumes of power conditioning systems for 8 point designs (8 variations of power, voltage, duty cycle and total run time) are derived. Finally, a development program is outlined for the critical components and subsystems. Author (GRA)

N77-29626# Department of Health, Education, and Welfare, Washington, D.C.
THE MARKETABILITY OF INTEGRATED ENERGY/UTILITY SYSTEMS
Dec. 1976 45 p Sponsored in part by NBS, Experimental Technology Incentives Program
(PB-266042/1) Avail: NTIS HC A03/MF A01 CSCL 13A

A marketing guide acquaints the prospective marketplace with the potential and underlying logic of the generic Integrated Utility System (IUS) concept. A sizeable number of educational and medical facilities may well be compatible with the IUS concept, and appropriate implementation of an IUS would bring about the realization of startlingly substantial annual dollar savings for the institution along with impressive energy savings. GRA

N77-29627# Department of Health, Education, and Welfare, Washington, D.C. Office of Facilities Engineering and Property Management.
INTEGRATED UTILITY SYSTEMS: FEASIBILITY STUDY AND CONCEPTUAL DESIGN AT THE UNIVERSITY OF FLORIDA
Oct. 1976 170 p refs Sponsored in part by NBS, Experimental Technology Incentives Program
(PB-266043/9) Avail: NTIS HC A08/MF A01 CSCL 13A

The technical feasibility and the economic benefits of an Integrated Utility System (IUS) at the University of Florida are addressed, as are the environmental and institutional factors. The recommended IUS alternates include select energy systems wherein one fourth to three fourths of the required electrical power is generated on-site with full utilization of the waste heat from the process for heating and cooling purposes. Full integration of the systems is achieved through incineration of solid waste for its heat content, and partial reuse of the effluent from the existing sewage treatment plant for equipment make-up water and for irrigation. GRA

N77-29628# Department of Health, Education, and Welfare, Washington, D.C. Office of Facilities Engineering and Property Management.
INTEGRATED UTILITY SYSTEMS: FEASIBILITY STUDY AND CONCEPTUAL DESIGN AT CENTRAL MICHIGAN UNIVERSITY
Dec. 1976 120 p Sponsored in part by NBS
(PB-266044/7) Avail: NTIS HC A06/MF A01 CSCL 13A

The technical feasibility and the economic benefits of an Integrated Utility System (IUS) at Central Michigan University are addressed, as are the environmental and institutional factors. The recommended IUS incorporates a Total Energy system whereir all of the required electric power is generated on-site with full utilization of the waste heat from the power cycle for heating and cooling purposes. System integration is achieved through incineration with heat recovery of solid waste from both the University and the City of Mount Pleasant. GRA

N77-29629# Federal Energy Administration, Washington, D. C. Office of Data Analysis.
PROJECT INDEPENDENCE EVALUATION SYSTEM (PIES) DOCUMENTATION. VOLUME 15: STANDARD DATA TABLES FOR PIES
Sep. 1976 288 p
(PB-265195/8; FEA/N-77/116) Avail: NTIS HC A13/MF A01 CSCL 10A

The standard tables given are an adjunct to the documentation of the Project Independence Evaluation System. The standard tables provide a rigid format for the presentation of data to be used in generation of the linear program matrix. The tables are the synthesis of all raw data used in the matrix after arithmetic operations have been performed. In general, there are three categories of standard tables: facilities, materials, and transportation. Units for each entry are in standard PIES physical quantities. GRA

N77-29630# ICF, Inc., Washington, D.C.
PROJECT INDEPENDENCE EVALUATION SYSTEM (PIES) DOCUMENTATION. VOLUME 8: METHODOLOGY FOR ENABLING THE PIES OIL AND GAS SUPPLY CURVES TO RESPOND TO NON-CONSTANT PRICES
Sep. 1976 42 p
(Contract FEA-CO-05-50301-00)
(PB-265086/9; FEA/N-76/418) Avail: NTIS HC A03/MF A01 CSCL 10A

The possibility is discussed of increased capability of the FEA oil and supply modelling system to respond to non-constant price trajectories, rather than constant, instantaneous patterns. More specifically, it investigates the efficacy of enabling the FEA oil and gas supply models to respond to prices that are ramped, especially in the short run. GRA

N77-29631# Illinois Univ., Urbana-Champaign. Dept. of Civil Engineering.
DEVELOPMENT OF AN AEROSOL SIZE CLASSIFIER Final Report
Larry J. Forney Mar. 1977 64 p refs
(Grant NSF ENG-75-10303)
(PB-266078/5; UILU-ENG-77-1006) Avail: NTIS HC A04/MF A01 CSCL 10B

The design of a versatile instrument for aerosol assessment is described. The single stage device incorporates the principal of virtual impaction and a continuously variable slit width to provide for ease of calibration, low internal wall losses, and potential for large sample volumes. Furthermore, the design provides the option of either fractionating particles into two size classes for mass or chemical analysis or determining entire particle size distributions. A dimensional analysis was made of the important parameters governing the instrument response. GRA

N77-29632# Environmental Protection Agency, Washington, D.C. Office of Energy, Minerals and Industry.
WESTERN ENERGY/ENVIRONMENT MONITORING STUDY: PLANNING AND COORDINATION SUMMARY
Gregory J. Dalessio Mar. 1977 25 p
(PB-266256/7; EPA-600/7-77-024) Avail: NTIS HC A02/MF A01 CSCL 10A

The planning, coordination and implementation mechanisms which provide the framework for the Western Energy/Environment Monitoring Study are summarized. This study is a segment of

the Interagency Energy/Environment Research and Development Program administered by EPA. GRA

N77-29633# Commerce Dept., Washington, D.C. Domestic and International Business Administration.
FORECAST OF LIKELY US ENERGY SUPPLY/DEMAND BALANCES FOR 1985 AND 2000, AND IMPLICATIONS FOR US ENERGY POLICY
Joseph F. Gustaferro 20 Jan. 1977 174 p refs
(PB-266240/1; DIBA/EAD-77/1) Avail: NTIS HC A07/MF A01 CSCL 10A

Future U.S. energy balances based on a 1.2% per capita energy growth rate are projected. These balances take into account declining U.S. and world oil and gas reserves and limitations on fuel substitutability. GRA

N77-29634# California Univ., Los Angeles. Dept. of Chemical, Nuclear, and Thermal Engineering.
A PARAMETRIC UTILITY COMPARISON OF COAL AND NUCLEAR ELECTRICITY GENERATION
Kenneth M. Maurer Feb. 1977 72 p refs
(Grant NSF OEP-75-20318)
(PB-266064/5; UCLA-ENG-7719; NSF/RA-770056) Avail: NTIS HC A04/MF A01 CSCL 10B

The advantages and limitations of an explicit quantitative model for decision making are discussed. Several different quantitative models are presented, noting that the use of an expected utility maximization decision rule allows both the direct incorporation of multidimensional descriptions of the possible outcomes, and considerations of risk averse behavior. A broad class of utility functions, characterized by linear risk tolerance, was considered and extended to a multidimensional form. GRA

N77-29635# Westinghouse Research Labs., Pittsburgh, Pa.
THIN FILM SOLAR CELLS FOR TERRESTRIAL APPLICATIONS Final Report, 1 Aug. 1974 - 31 Jul. 1976
F. A. Shirland, W. J. Biter, E. W. Greeneich, A. J. Simon, and T. P. Brody Feb. 1977 103 p refs
(Grant NSF AER-74-14918-A01)
(PB-265983/7; Rept-77-9F9-TFSOL-RI) Avail: NTIS HC A06/MF A01 CSCL 10B

A design has evolved from an earlier space cell which is promising for large scale terrestrial use. This is a front wall cell on zinc plated copper foil substrate with an evaporated grid and an integral glass cover formed by r.f. sputtering. This cell is suitable for low cost mass fabrication. Though it has not been fully proven it combines the constructional features that showed maximum stability in operation in the past. A standard process laboratory line was operated with fixed process parameters for 14 months. Over this period, cell efficiency averaged 4.9% with an 81% yield. Earlier space cells were encapsulated to protect them from the atmosphere and subjected to accelerated life tests. They showed no loss of output after 20 month of 50% daily duty cycles at operating temperatures of 40C, and 60C, and 80C. Cells operated at 100C showed an 11% loss of output over the 20 months of accelerated use which is attributed to diffusion of copper from the Cu2S into the CdS. GRA

N77-29636# Association of Physical Plant Administrators of Univ. and Coll., Washington, D. C.
ENERGY CONSERVATION ON CAMPUS. VOLUME 1: GUIDELINES
Dec. 1976 42 p 2 Vol.
(Contract FEA-CO-04-50247-00)
(PB-266211/2; FEA/D-76/229) Avail: NTIS HC A03/MF A01 CSCL 13A

The development of a campus energy management program including policy elements, formation of an energy management committee, appointment of an energy management officer, and measuring and evaluating the energy use of campus buildings is discussed. Various areas in which reductions in energy consumption are possible are noted. Checklists of specific energy conservation actions to be taken in the major areas are presented along with samples of various energy information and survey forms. GRA

N77-29637# Association of Physical Plant Administrators of Univ. and Coll., Washington, D. C.
ENERGY CONSERVATION ON CAMPUS. VOLUME 2: CASE STUDIES
Dec. 1976 35 p 2 Vol.
(Contract FEA-CO-04-50247-00)
(PB-266212/0; FEA/D-76/230) Avail: NTIS HC A03/MF A01 CSCL 13A

Case studies covering examples of various energy conservation actions taken on college and university campuses across the country and in Canada along with the resulting costs savings are reported. GRA

N77-29638# Lockheed Missiles and Space Co., Huntsville, Ala.
HEAT PUMPS: SUBSTITUTES FOR OUTMODED FOSSIL-FUELED SYSTEMS Final Report, Apr. - Jun. 1976
E. A. Picklesimer Apr. 1977 39 p refs
(Contract EPA-68-02-1331)
(PB-266218/7; LMSC-HREC-PR-D496880; EPA-600/7-77-035) Avail: NTIS HC A03/MF A01 CSCL 13A

The state-of-the-art is reviewed relative to development, capacity, and adequacy of the heat pump as a potential replacement for outmoded fossil-fueled heating and cooling systems in the residential and commercial sector. Projections are made of the rate at which heat pumps need to be manufactured and installed in the commercial and residential sectors as the projected service life of fossil-fuel equipment expires. The conclusion is reached that the heat pump is economical only as a total space comfort system. Based on January 1, 1976, fuel prices, the heat pump is about 25% more expensive to operate than comparable fossil-fuel heating systems. If the trend of increasing fuel prices continues, the heat pump will be more economical to operate than comparable fossil-fueled heating systems by 1980. GRA

N77-29639# Southern Methodist Univ., Dallas, Tex.
PROCEEDINGS OF THE NATIONAL WORKSHOP ON LOW COST POLYCRYSTALLINE SILICON SOLAR CELLS
Ting L. Chu and Shirley S. Chu Dec. 1976 476 p refs Conf. held at Southern Methodist Univ., Dallas, 18-19 May 1976 Sponsored in part by ERDA
(Contract NSF AER-76-10526)
(PB-266563/6; NSF/RA-760487) Avail: NTIS HC A21/MF A01 CSCL 10B

A National Workshop on Low Cost Polycrystalline Silicon Solar Cells was held to promote interactions among various researchers actively engaged or interested in polycrystalline silicon solar cells. The objectives of the Workshop were: (1) to review the current status of polycrystalline silicon solar cells; (2) to review the preparation and characterization of polycrystalline silicon and the fabrication of polycrystalline silicon solar cells; and (3) to identify the key problems associated with the fabrication of large area, low cost, good efficiency, polycrystalline silicon solar cells. GRA

N77-29640# Mitre Corp., McLean, Va. Metrek Div.
ANALYSIS OF ENERGY PROJECTIONS FOR INFRASTRUCTURE DEVELOPMENT REQUIREMENTS Final Report
John G. Leigh Feb. 1977 80 p refs
(Contract DOT-FH-11-9209)
(PB-266419/1; MTR-7455) Avail: NTIS HC A05/MF A01 CSCL 10A

Current energy models and projections are surveyed. Four are analyzed in detail to provide a basis for projecting infrastructure and highway development needs associated with energy production. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N77-29641 Michigan Univ., Ann Arbor.
GASEOUS EMISSIONS FROM UNREGULATED MOBILE SOURCES Ph.D. Thesis

Donald Edward Zinger 1976 287 p
Avail: Univ. Microfilms Order No. 77-8074

The impact of gaseous exhaust emissions are determined for the following categories of mobile sources which are currently not covered by national emission regulations: (1) farm equipment, (2) merchant vessels, (3) locomotives, (4) lawn and garden implements, (5) snowmobiles, (6) outboard motors, (7) transport refrigeration units; and (8) helicopters. The results show that farm equipment can be responsible for a significant portion of the total oxides of nitrogen and carbon monoxide emissions in agricultural communities. Snowmobile engines emit a substantial amount of unburned hydrocarbons during the winter months in areas of their intense use. At the present time emissions from merchant vessels, locomotives, lawn and garden implements, outboard motors, and transport refrigeration units do not appear to contribute significantly to the total air pollution burden in the regions studied, but may be significant in other localized areas.
Dissert. Abstr.

N77-29642 Texas Univ. Health Science Center, Houston.
SOME MICROCLIMATE AND AIR QUALITY IMPLICATIONS OF URBANIZATION IN A SOUTHERN COASTAL FOREST Ph.D. Thesis
Lawrence William Whitehead 1976 165 p
Avail: Univ. Microfilms Order No. 77-9283

The human development of forested land for urban and suburban uses raises the possibility that the microclimate effects of the forest will adversely modify the human setting. Forests slow wind speed very substantially, increase relative humidity while reducing maximum daytime air temperature, and tend to produce an inversion in morning hours while reducing the solar radiation recieved at the ground. These changes reduce pollutant dispersion, may lead to automobile exhaust trapping under the canopy, and will alter comfort conditions. Further, forest will both remove and produce various air pollutants. This project was planned to describe these conditions and develop predictive models for planning purposes, relating forest descriptors to the various microclimate parameters. Dissert. Abstr.

N77-29643 California Univ., Los Angeles.
THE PREPARATION OF EMISSION INVENTORIES IN THE IMPLEMENTATION PLANNING PROCESS Ph.D. Thesis
Ronald Long Tan 1976 187 p
Avail: Univ. Microfilms Order No. 77-7693

The Clean Air Act Amendments of 1970 and the subsequent formation of the Environmental Protection Agency marked the commencement of a concerted federal effort to combat air pollution. Among the requirements of the amendments was the preparation of implementation plans by all the states to delineate each state's strategy in attaining and maintaining the National Ambient Air Quality Standards. A crucial aspect of the implementation plan development process is the compilation of an emission inventory. Dissert. Abstr.

N77-29644 Michigan Univ., Ann Arbor.
THE LAND-WATER INTERFACE OF INLAND LAKES AND ITS IMPLICATIONS FOR ECOLOGICAL PLANNING Ph.D. Thesis
Sari Jane Sommarstrom 1976 240 p
Avail: Univ. Microfilms Order No. 77-8039

A theoretical scheme of evaluation is proposed to help in the effective translation of the critical considerations of ecological planning for the shorezone to those most involved: decision-makers, planning staff, and the public. The proposed evaluation scheme is a simplified approach, not a more complex methodology. The format is kept simple and the basic information essential for sound environmental decision-making is indicated. As a result, the essence of environmental concerns can be easily identified and concisely described. The scheme also has an educational value by helping laypersons understand the importance of certain measures and controls through use-cause-effect relationships.
Dissert. Abstr.

N77-29645 Cornell Univ., Ithaca, N.Y.
ENERGY ANALYSIS AND COASTAL SHELF RESOURCE MANAGEMENT: NUCLEAR POWER GENERATION VS. SEA-FOOD PROTEIN PRODUCTION IN THE NORTHEAST REGION OF THE US Ph.D. Thesis
Stephen P. Rochereau 1976 203 p
Avail: Univ. Microfilms Order No. 77-8380

A probability model is then developed to relate the annual energy impact of a 1200 megawatt reactor (defined by the energy content of the fishery biota killed by once-thru cooling) to the annual energy ratio of the Northeast fishing fleet. The model considers the successive levels of biological development states attained by the fishery biota killed, and the typical coastal siting alternatives for power reactors in the region. Conflictual activity-development scenarios are then tested at different levels of aggregation for illustration purposes. Dissert. Abstr.

N77-29646 California Univ., Los Angeles.
REDUCTION OF NITRIC-OXIDE FORMATION IN METHANE-AIR FLAMES BY SECONDARY-AIR INJECTION Ph.D. Thesis
Richard Leslie Gay 1976 144 p
Avail: Univ. Microfilms Order No. 77-7666

The problem of reducing nitric-oxide formation in a pre-mixed, one-atmosphere methane-air flame has been studied using a laboratory-scale (7.6 cm diameter) porous-plug burner and a molecular-beam mass-spectrometer sampling system. The injection of secondary air was used to quench nitric-oxide formation. For equivalence ratios of 0.8, 1.0 and 1.1, the signal intensity at m/e = 30 was measured along the burner centerline from the flameholder (z = 0 to z = 250 mm. Two distinct reaction regions were found: a primary reaction zone, which occupied approximately the first 4-5 mm, and a secondary reaction zone, which occupied the rest of the sampling distance. A distinctive peak corresponding to the formation and consumption of H2CO defined the primary reaction zone. Nitric oxide was formed in the secondary reaction zone. The data discount the formation of intercept NO. Dissert. Abstr.

N77-29647# California Univ., Livermore. Lawrence Livermore Lab.
REVIEW OF AIR QUALITY MODELING TECHNIQUES
L. C. Rosen Jan. 1977 43 p refs
(Contract W-7405-eng-48)
(UCID-17382) Avail: NTIS HC A03/MF A01

The models developed heretofore utilize some mathematical technique to represent the actual physical processes of air pollution transport in a workable fashion. Representative models are discussed with emphasis on their advantages, disadvantages, and applicability. ERA

N77-29648# Battelle Pacific Northwest Labs., Richland, Wash.
DRY REMOVAL OF AIR POLLUTANTS BY VEGETATION CANOPIES
T. G. Droppo Sep. 1976 9 p refs Presented at the 4th Natl. Conf. on Fire and Forest Meteorology, St. Louis, 16-18 Nov. 1976
(Contracts E(45-1)-1830; EPA-68-02-1747)
(BNWL-SA-5973; Conf-761121-4) Avail: NTIS HC A02/MF A01

Processes involved are discussed in a resistance model framework. Values from the literature and results of current field tests relating to rates of dry removal are summarized for selected gases and particles, and the experimental accuracy of particulate sulfur deposition values is discussed. ERA

N77-29649# Nuklear-Chemie und -Metallurgie, G.m.b.H., Wolfgang Bei Hanau (West Germany).
DEVELOPMENT AND TESTING OF A SCRUBBING METHOD TO PURIFY EXHAUSTS OF AN OFFENSIVE ODOR Final Report
Hans Holtz and Heinrich Quillmann Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1976 29 p In GERMAN; ENGLISH summary
(Contract BMFT-NTS-1001; DFVLR-BPT-01-VQ-015)
(BMFT-FB-T-76-68) Avail: NTIS HC A03/MF A01; ZLDI, Munich DM 6.10

The procedure to deodorize exhaust air by means of sodium chlorite in acid, aqueous solutions was tested in a number of different industrial firms, using a newly developed cross-current scrubber. The scrubber performed perfectly, and the individual results are positive. In one case, the procedure was successfully employed on a large scale. Work relating to controlling acid

and chlorite addition via pH value and redox potential was successfully completed, and it is now also possible, using this procedure, to purify exhaust air fluctuating in quantity and/or pollutant concentration. Author (ESA)

N77-29650# Loughborough Univ. of Technology (England). Dept. of Transport Technology.

NOISE BURDENS AT US AIRPORTS

N. J. Deva-Aditya and J. B. Ollerhead Mar. 1977 59 p refs (Contract SN/1170/012)

(TT-7703) Avail: NTIS HC A04/MF A01

An assessment of the magnitude of the community impact of aircraft noise in the year 1975 is made through a study of 52 U.S. airports. The calculations are based upon a simplified prediction model. It is estimated that in that year approximately 2.5% of the national population would have been seriously annoyed by the noise of commercial aircraft operations. The good neighborliness of airports is assessed in terms of the noise burden factor which is defined as the number of man-days of annoyance per passenger movement. Nearly 50% of the sample yield factors of less than 1.0 which is suggested as a reasonable planning target. The effect of the introduction of the larger, quieter wide-bodied aircraft is estimated to more than halve average noise burden factors between the years 1970 and 1975. Author (ESA)

N77-29651# Loughborough Univ. of Technology (England). Dept. of Transport Technology.

NOISE BURDENS AT BRITISH REGIONAL AIRPORTS

N. J. Deva-Aditya, R. D. Hooper, and J. B. Ollerhead Mar. 1977 32 p refs (Contract SN/1170/012)

(TT-7704) Avail: NTIS HC A03/MF A01

Estimates of the numbers of people annoyed by aircraft noise at 10 regional airports in August 1972 are compared with the figure for London (Heathrow). Despite a considerably smaller passenger traffic volume the 10 regional airports as a group are estimated to adversely affect as many people as does Heathrow suggesting that in terms of relative noise nuisance it may be better to concentrate traffic at a single large airport rather than to disperse it to a number of smaller ones. The noise burden factor concept (the number of man-days of serious noise annoyance per passenger movement) provides a means for comparing airport noise efficiencies. As well as quantifying the fact that Heathrow can be regarded as a better neighbor than some of the regional airports, calculations of this factor show that the noise problem in the U.K. is rather worse than that in the U.S.A., due primarily to higher population densities. It is estimated that in the U.K. as a whole, more than 1.5 million people near commercial airports are seriously annoyed by aircraft noise. Author (ESA)

N77-29652# Loughborough Univ. of Technology (England). Dept. of Transport Technology.

CRITERIA FOR ASSESSING THE ACCEPTABILITY OF AIRPORT NOISE NUISANCE. VOLUME 1: THE ROLE OF SOCIAL JUSTICE

N. J. Deva-Aditya Feb. 1976 32 p refs 2 Vol. (Contract SN/1170/012)

(TT-7503-Vol-1) Avail: NTIS HC A03/MF A01

Research into community noise problems has provided methods by which environmental planners may estimate the total impact of a given noise exposure. The special problem of aircraft noise nuisance with respect to notions of social justice is discussed. The general role of social justice in contemporary policy-making (the actual position) is compared with the ideal notions of justice which would be defined in an ideal world (the original position). The variation between this ideal notion and other notions of justice applicable to the airport conflict (airport position) are also discussed in the relation to airport policy-making. Author (ESA)

N77-29653# Loughborough Univ. of Technology (England). Dept. of Transport Technology.

CRITERIA FOR ASSESSING THE ACCEPTABILITY OF AIRPORT NOISE NUISANCE. VOLUME 2: APPLICATION OF SOCIAL JUSTICE PRINCIPLES

N. J. Deva-Aditya Feb. 1976 78 p refs 2 Vol. (Contract SN/1170/012)

(TT-7503-Vol-2) Avail: NTIS HC A05/MF A01

The airport conflict (its effect on society) within a dimension of justice is examined and relevant facets are identified with respect to several contemporary notions of social justice. Application of some social justice principles to the problems of airport noise and airport planning policies is made. ESA

N77-29654# Environmental Research and Technology, Inc., Concord, Mass.

THE LIVERMORE REGIONAL AIR QUALITY MODEL (LIRAQ): A TECHNICAL REVIEW AND MARKET ANALYSIS

Arthur Bass, Alan Q. Eschenroder, and Bruce A. Egan Feb. 1977 76 p refs

(Grant NSF ENV-76-19981)

(PB-266066/0; ERT-P-2348-1) Avail: NTIS HC A05/MF A01 CSCL 13B

The marketability of the LIRAQ air quality simulation model, which was designed for use in the San Francisco Bay area is investigated. Variety of air quality policy, planning, and assessment studies is also studied. LIRAQ exists in two versions. The first, LIRAQ-1 treats pollutant species such as carbon monoxide which are non-reactive. The second version, LIRAQ-2, treats reactive pollutants such as non-methane hydrocarbons, ozone and nitrogen dioxide. The following topics are reviewed: (1) summary findings and recommendations concerning the present model; (2) a technical review of the LIRAQ model, which includes the general characteristics, program architecture, and verification history; (3) the data requirements for usage of the model; (4) a comparison of LIRAQ with other models including trajectory and grid models; (5) a market analysis of LIRAQ; and (6) transfer of LIRAQ model technology. An appendix includes a sample output of a problem formulator. GRA

N77-29655# Argonne National Lab., Ill.

THE ENVIRONMENTAL EFFECTS OF USING COAL FOR GENERATING ELECTRICITY

C. D. Brown, E. H. Dettman, R. A. Hinchman, J. D. Jastrow, and F. C. Kornegay May 1977 227 p refs (Contract W-31-109-eng-38)

(PB-267237/6; NUREG-0252) Avail: NTIS HC A11/MF A01 CSCL 13B

The identification of health and ecological impacts of using coal for generating electrical power requires an understanding of the entire coal cycle, which can be described chronologically as extraction - processing - transportation - combustion - waste. Each segment of the cycle is described, with emphasis placed on those topics where potential health and ecological impacts may occur. Underground and surface mining, coal processing, and transportation including rail, barge, slurry pipeline, truck, and conveyor are described. The combustion, combustion wastes, and airborne combustion emmissions are predicted for a model 1000-MWe coal-fired power plant. The description of this plant includes ancillary structures, daily and annual fuel requirements assuming a 70% capacity factor, coal storage piles, and wastes generated. GRA

N77-29656# Missouri Univ., Columbia. School of Forestry, Fisheries and Wildlife.

ASPECTS OF RESERVOIR-POWER STATION INTERACTIONS: SOME EFFECTS OF HEAT ON PHYSICO-CHEMISTRY, 'AUFWUCHS' ECOLOGY, AND PLANKTON METABOLISM Ph.D. Thesis

Gerald Kane OBryan May 1976 190 p refs

(PB-266326/8; W77-07102; OWRT-B-039-MO(6)) Avail: NTIS HC A09/MF A01 CSCL 13B

An investigation of 26 physico-chemical parameters, plankton metabolism, and the accural, composition and metabolism of Aufwuchs was conducted on a reservoir that received a thermal effluent. The only observed effects attributable to the thermal effluent (other than a slight temperature increase) were a slight increase in turbidity, percent saturation of oxygen and reduced ice cover. The heated effluent had no consistent effect on plankton community metabolism, or on the accrual of Aufwauchs. The Aufwauchs study indicates that short-term studies to characterize the trophic nature of waters, or for pollution surveys, are of

questionable value because of variability within the community. GRA

N77-29657# Radian Corp., Austin, Tex.
INDUSTRIAL PROCESS PROFILES FOR ENVIRONMENTAL USE. CHAPTER 5: BASIC PETROCHEMICALS INDUSTRY Technical Report, Aug. 1975 - Nov. 1976
T. B. Parsons, C. M. Thompson, and G. E. Wilkins Jan. 1977 155 p refs
(Contract EPA-68-02-1319)
(PB-266224/5; EPA-600/2-77-023e) Avail: NTIS HC A08/MF A01 CSCL 07A

The catalog was developed to aid in defining the environmental impacts of U.S. industrial activity. Entries for each industry are in consistent format and form separate chapters of the catalog. The basic petroleum industry includes companies that treat hydrocarbon streams from the petroleum refining industry, as well as natural gas liquids from the oil and gas production industry. From these raw materials, feedstocks, are produced for the organic chemicals industry. The products are pure or mixed chemicals for use as solvents or chemical intermediates. GRA

N77-29658# JRB Associates, McLean, Va.
TECHNOLOGICAL FEASIBILITY ASSESSMENT AND INFLATIONARY IMPACT STATEMENT OF THE PROPOSED STANDARD FOR SULFUR DIOXIDE Final Economic Impact Statement
18 Feb. 1977 319 p refs
(Contract DL-J-9-F-6-0041)
(PB-266151/0; OSHA-ISS-77-0218) Avail: NTIS HC A14/MF A01 CSCL 06J

Requirements of the proposed standard for sulfur dioxide are analyzed. Impacted industries are identified, as well as the industrial processes that produce employee exposure, and the feasible control strategies for those processes. Estimates of the anticipated costs for compliance with the standard (for several exposure limits) are provided, and the economic impact of these compliance costs is stated for each of the eleven identified industries. The total cost of compliance to the proposed 2 ppm TWA/10 ppm ceiling standard is about $245 million in total capital investment and about $166 million for annual operating and maintenance and capital recovery costs. Major benefits associated with a reduction in the present standard are discussed. GRA

N77-29659# Control Data Corp., Minneapolis, Minn.
AN OBJECTIVE ANALYSIS TECHNIQUE FOR THE REGIONAL AIR POLLUTION STUDY, PART 1 Final Report
D. Hovland, D. Dartt, and K. Gage Jan. 1977 55 p refs
(Contract EPA-68-02-1827)
(PB-266255/9; EPA-600/4-77-002a) Avail: NTIS HC A04/MF A01 CSCL 04A

The program is designed to produce a 5-km spaced horizontal grid analysis from a distribution of observations which are sparse at the boundaries of the grid and dense near the center. An iterative scan procedure is used successively to correct an intial guess field until the analysis agrees reasonably well with observations. A procedure is used where widely spaced observations and a large scan radius are first used to approximate the field. This is successively followed by the addition of more observational data and reduction in scan radius until the field converges to the desired analysis (usually five iterations are required). This procedure of simultaneously adding more data and shrinking the scan radius insures that the small-scale variability in areas of dense observations does not propagate into the surrounding areas where there are few data. GRA

N77-29660# Wyoming Univ., Laramie. Dept. of Physics and Astronomy.
ASSESSMENT OF ATMOSPHERIC CONDENSATION NUCLEI ASSOCIATED WITH JET AIRCRAFT TRAFFIC Annual Report, May 1976 - Apr. 1977
D. J. Hofmann and J. M. Rosen 1 Apr. 1977 12 p
(Contract N00014-76-C-0170; NR Proj. 211-151)
(AD-A036504; CN-7) Avail: NTIS HC A02/MF A01 CSCL 13/2

Measurement of condensation nuclei (CN) in the size range r = or > 0.01 micrometers by balloon-borne detectors from a number of stations suggests the following: (a) CN profiles (concentration vs altitude) to 30km are somewhat uniform globally with typically high (approximately 1000/cc) concentrations in the troposphere and typically low (approximately 10/cc) concentrations in the stratosphere. (b) The troposhere appears to serve as a CN source for the stratosphere. (c) CN occuring in tropospheric layers are partially volatile at 150C. (d) A CN layer observed in the stratosphere at 22km was apparently due to the jet engine emissions of a high flying aircraft. In addition, larger particles (r = or > 0.15 micrometers) in the stratospheric sulfate layer have continued to decay uniformly following an injection apparently due to a volcanic eruption in October 1974. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N77-29661 Minnesota Univ., Minneapolis.
MASS SPECTROMETRIC MEASUREMENTS OF ATOMIC NITROGEN IN THE EARTH'S THERMOSPHERE Ph.D. Thesis
Mark Jerome Engebretson 1976 148 p
Avail: Univ. Microfilms Order No. 77-7027

Analysis of the surface recombination effects in the ion source of the Open Source Mass Spectrometer on Atmosphere Explorer-C makes possible for the first time reliable measurement of atomic nitrogen in the earth's upper atmosphere at altitudes above 300 km. Ambient atomic nitrogen combines with adsorbed oxygen on the walls of the quasi-open ionization chamber to form nitric oxide, which is then detected by the mass spectrometer. The small fraction of N that is not recombined constitutes an independent check upon the validity of using this reaction mechanism, and in certain operating modes provides the most useful data. Analysis of data on a global scale at high altitudes indicates large diurnal and seasonal variations, but only a moderate increase during geomagnetic storms. Dissert. Abstr.

N77-29662 Wisconsin Univ., Madison.
CATION ORDERING IN SUBGROUP SYMMETRY IN THE MICAS Ph.D. Thesis
Stephen Jay Guggenheim 1976 71 p
Avail: Univ. Microfilms Order No. 77-3402

The crystal structure of margarite-2M1 from Chester County, Pennsylvania, has been refined as an ordered derivative structure in subgroup Cc of the ideal space group C2/c. Because of the high pseudosymmetry involved, successful refinement by least-squares required initial movement of atomic parameters away from those of the disordered phase towards those of the possible ordered models predicted by a distance least-squares program. Ordering of tetrahedral Si and Al is nearly complete in a pattern that violates centrosymmetry between the tow tetrahedral sheets within a 2:1 layer. Compositionally similar tetrahedra in adjacent sheets are related instead by a pseudo two-fold axis that extends laterally through the octahedral Al atoms and is normal to the direction of intralayer shift. Dissert. Abstr.

N77-29663 Rutgers - The State Univ., New Brunswick, N. J.
STRUCTURAL REFINEMENTS OF DOLOMITE AND A MAGNESIAN CALCITE Ph.D. Thesis
Penelope Louise Althoff 1976 30 p
Avail: Univ. Microfilms Order No. 77-7196

The structures of dolomite and a calcite containing 10 mol % $MgCO_3$ were anisotropically refined using single-crystal X-ray techniques. Interatomic bond lengths and angles in the dolomite structure are more ideal than those in the calcite, magnesite, and magnesian calcite structures. Therefore the octahedra are less distorted and provide better cation shielding for both calcium and magnesium in dolomite than in the other carbonate structures. Substitution of magnesium into the calcite structure distorts the octahedra diminishing cation shielding. This results in exaggerated thermal motion of the ions and bond weakening. Dissert. Abstr.

N77-29664 Alaska Univ., College.
A COMPUTER MODEL OF THE POLAR E-REGION IONOSPHERE Ph.D. Thesis
Brenton John Watkins 1976 120 p
Avail: Univ. Microfilms Order No. 77-8563

A numerical computer model of the geomagnetically quiet, high latitude F-region ionosphere has been constructed. A mathematical model of the steady state polar convective electric field pattern is used in conjunction with the production and loss processes (viz., photoionization, auroral particle precipitation, chemical recombination and polar wind loss). The continuity equation is solved for the ionization density as a unit volume moves across the polar cap and through the auroral zones. The problem is worked with as realistic a geometry as possible to incorporate the effects of the separation of the geographic pole and invariant pole: This is necessary to evaluate the universal time dependence of the ionosphere. Dissert. Abstr.

N77-29665 Stanford Univ., Calif.
SLOPE STABILITY OF THE LOMERIAS MUERTAS AREA, SAN BENITO COUNTY, CALIFORNIA Ph.D. Thesis
Deane Oberste-Lehn 1976 247 p
Avail: Univ. Microfilms Order No. 77-7137

The factors contributing to instability were identified and evaluated, processes of slope failure were observed and measured, and a history of landsliding was reconstructed for seasonal, historic, and geologic time frames. The overall purpose was to understand better the interrelations of processes, conditions, and earth materials in order to improve our capacity for appraising the stability of natural slopes. In the Lomerias Muertas area slope failure invariably starts by sliding, although many of the landslide masses soon develop into earthflows. Hinge slides are characteristic features of the steepest slopes, and slumps more commonly form on bedding dip slopes and other less steep slopes. Major controlling factors of landslide distribution are lithology, structure, and drainage. Dissert. Abstr.

N77-29666 California Univ., Los Angeles.
VORTICITY IN MARITIME CUMULUS CLOUDS AND ITS EFFECTS ON THE LARGE-SCALE BUDGET OF VORTICITY IN THE TROPICS Ph.D. Thesis
Jan-Hwa Chu 1976 146 p
Avail: Univ. Microfilms Order No. 77-7659

The vorticity budget shows that, under disturbed weather situations, the horizontal advection and vorticity-divergence terms are dominant in the lower troposphere, while the vertical advection and twisting terms are significant in the upper troposphere. A large positive residual is found in the upper troposphere showing the importance of eddy vertical transport of vorticity and twisting effects due to convection. Under weakly disturbed situations, the vorticity budget shows a near balance between the local time change and the horizontal advection of vorticity. The residual of large-scale budget of vorticity can be diagnosed. Results show that the cloud-scale vertical transport of excess vorticity, the cloud-scale twisting effects, the vertical transport of vorticity excess in cloud environment are the effects of cumulus convection on the large-scale vorticity budget. Dissert. Abstr.

N77-29667 Purdue Univ., Lafayette, Ind.
A THEORETICAL INVESTIGATION OF MOIST ATMOSPHERIC CONVECTIVE MODES AS A FUNCTION OF RAYLEIGH NUMBER, PRANDTL NUMBER AND EDDY ANISOTROPY Ph.D. Thesis
David Lee Mitchell 1976 245 p
Avail: Univ. Microfilms Order No. 77-7498

A mathematical model consisting of a complete set of the linearized Boussinesq equations governing Rayleigh convection in a moist atmosphere was solved. The significant features of the model include: (1) anisotropic eddy heat and and momentum diffusion coefficients with the eddy viscosity for momentum varying with height through the convecting layer; (2) convection cells of general horizontal geometry as determined by parameter values appearing in a modified form of the generalized Christopherson shape function; (3) a non-zero complex stability factor allowing for steady and time-dependent convective modes; (4) a diabatic heating term in the conservation of energy equation allowing for the development of a moist atmospheric Rayleigh number (Ra); and (5) an atmospheric Prandtl number (Pr) where molecular viscosity and conductivity have been replaced by their eddy counterparts. Dissert. Abstr.

N77-29668 Illinois Univ., Urbana-Champaign.
THE CONSERVATION AND DISSIPATION OF ENERGY ASSOCIATED WITH ATMOSPHERIC ACOUSTIC GRAVITY WAVES Ph.D. Thesis.
Richard Edward Dubroff 1976 240 p
Avail: Univ. Microfilms Order No. 77-8978

Spectrum analysis was utilized to determine if the experimentally observed fluctuations in ionospheric electron content did, provide a manifestation of the filtering property of a weakly dissipative atmosphere. The experimental evidence was found to be in relatively good agreement with the hypothesized filtering effect. Having found that the dissipation of acoustic gravity waves is dependent upon the frequency and wavenumber of the waves, the weak dissipation theory would seem to imply that the dissipative processes in the atmosphere exert a filtering effect upon the acoustic gravity waves by allowing certain frequencies and wavenumber components to propagate in the atmosphere with minimal attenuation. Dissert. Abstr.

N77-29669 Wisconsin Univ., Madison.
HORIZONTAL CRUSTAL MOVEMENT IN THE SAN FRANCISCO BAY AREA Ph.D. Thesis
David Andrew Tyler 1976 200 p
Avail: Univ. Microfilms Order No. 77-3433

Repeated geodetic surveys in the San Francisco Bay Area of California were analyzed in order to define a pattern of horizontal crustal movement. Both relative and absolute mathematical models relating horizontal positions and time were developed. Free adjustments of all surveys of the networks were performed. In an attempt to compensate for the accumulation of rotation and scale error in the triangulation network, a pseudo-inverse adjustment technique was applied. This technique involves the conformal transformation of station positions developed in a free adjustment into initial approximations based on an a-priori assumption of crustal movement. Initial approximations were developed by constraining stations in the vicinity of the three major faults to move in the azimuth of the faults. Dissert. Abstr.

N77-29670 Stanford Univ., Calif.
DETERMINATION OF THERMOSPHERIC QUANTITIES FROM IONOSPHERIC RADIO OBSERVATIONS USING NUMERICAL SIMULATION Ph.D. Thesis
Dimitri Alexander Antoniadis 1976 140 p
Avail: Univ. Microfilms Order No. 77-7054

A numerical simulation method, based on theoretical thermospheric modeling is developed. The method is used with incoherent scatter data to determine diurnal vertical profiles of wind and corresponding pressure gradients for a day in each of the four seasons. A numerical ionospheric simulation method is developed. The method is used to determine time dependent vertical plasma drifts (induced by neutral winds and/or by electric fields), and exospheric neutral temperatures from electron content, and peak electron concentration data. Results are presented for a typical equinox day at the East and West Coasts of the U.S.A. Dissert. Abstr.

N77-29671 Catholic Univ. of America, Washington, D. C.
ARRAY DESIGN AND ALORGITHMS FOR OMNIDIRECTIONAL DETECTION AND ESTIMATION OF SEISMIC EVENTS Ph.D. Thesis
Paul Rodgers Lintz 1977 186 p
Avail: Univ. Microfilms Order No. 77-8733

Fourier and other orthogonal functions, such as Walsh functions, were studied to identify and thus reduce the effects of sidelobes of discrete acoustic sensor arrays such as the Large Aperture Seismic Array (LASA). Desirable array geometry for omnidirectional beamforming is first investigated, then an algorithm to map existing arrays into more desirable arrays is presented. Finally, an example of sidelobe identification and reduction by orthogonal functions is demonstrated by mapping the LASA array into a more desirable array and using mixtures of Fourier and Walsh functions to identify the sidelobes of the power detector and of the Fisher detector. Dissert. Abstr.

N77-29672*# National Aeronautics and Space Administration, Washington, D. C.
JOINT DOCUMENT CONCERNING GEOLOGICAL STUDIES FROM 1971 - 1975
Aug. 1977 27 p refs Prepared in cooperation with the Acad. of Sciences, Moscow
(NASA-TM-78318) Avail: NTIS HC A03/MF A01 CSCL 08G

In 1971, a joint Soviet-Americam Working Group on Remote Sensing of the Natural Environment was established. It was organized into a number of discipline panels, one of which was on geology. Membership on this panel came from the Geological Survey of the United States and from the Institute of Geology of the U.S.S.R. Academy of Sciences and Ministry Geology of the U.S.S.R.. During the period 1971-1975, this panel conducted coordinated research in the use of space remote sensing data in the field of geology. A summary of that coordinated research effort is presented. Author

N77-29673*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MONTE CARLO ANALYSIS OF UNCERTAINTY PROPAGATION IN A STRATOSPHERIC MODEL. 1: DEVELOPMENT OF A CONCISE STRATOSPHERIC MODEL
R. D. Rundel (NASA/Johnson Space Center), D. M. Butler, and R. S. Stolarski May 1977 35 p refs Submitted for publication
(NASA-TM-X-71360; X-624-77-122) Avail: NTIS HC A03/MF A01 CSCL 04A

A concise model has been developed to analyze uncertainties in stratospheric perturbations, yet uses a minimum of computer time and is complete enough to represent the results of more complex models. The steady state model applies iteration to achieve coupling between interacting species. The species are determined from diffusion equations with appropriate sources and sinks. Diurnal effects due to chlorine nitrate formation are accounted for by analytic approximation. The model has been used to evaluate steady state perturbations due to injections of chlorine and NO(X). Author

N77-29674# California Univ., Livermore. Lawrence Livermore Lab.
FEASIBILITY OF CREATING REDUCED-DENSITY CHANNELS IN AIR BY ABSORPTION OF LASER RADIATION
A. Edwards, M. D. Feit, and J. A. Fleck, Jr. Sep. 1976 33 p refs
(Contracts W-7405-eng-48; NAONR-11-76)
(UCRL-52174) Avail: NTIS HC A03/MF A01

The possibility of using laser beams to form low density channels in air was studied. Such channels could increase the useful range of neutral particles, electron beams, ultraviolet and X-ray quanta, etc. The possible mechanisms considered were air breakdown by a collimated beam, breakdown waves proceeding backward from a focal spot, laser-supported detonation waves, and atmospheric heating by selective molecular absorption. These schemes all fail for various reasons including thermal blooming, excessive energy requirements, and the inhomogeneity of normal dirty air breakdown. ERA

N77-29675# Centre National d'Etudes Spatiales, Toulouse (France).
MAGNETOSPHERE MODELS [LES MODELES DE MAGNETOSPHERE]
Jean-Claude Kosik Mar. 1977 79 p refs In FRENCH; ENGLISH summary
(CNES-NT-68) Avail: NTIS HC A05/MF A01

The most recent magnetospheric models are reviewed. After a short overview of the particle environment, a synthetic survey of the problem is given. For each feature of magnetospheric modelling (boundary, current sheet, ring-current) the approaches used by different authors are described. In the second part a description is given of the magnetospheric models, divided into four groups. In the last part, the different uses of magnetospheric models are illustrated by means of examples. Author (ESA)

N77-29676# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
STUDY OF D-REGION IONOSPHERE USING RADIO WAVE INTERACTION TECHNIQUE Final Report, 1 Oct. 1975 - 30 Sep. 1976
H. S. Lee and A. J. Ferraro 18 Feb. 1977 104 p refs
(Contract N00014-75-C-0178; NR Proj. 089-063; RR0320801)
(AD-A038413; PSU-IRL-FR-77/1) Avail: NTIS HC A06/MF A01 CSCL 04/1

This report describes the outcome of an ionospheric D-region study made with the wave interaction experimental technique mainly using the all-digitalized facilities at the Pennsylvania State University. Theoretical basis and the experimental evidence of the presence of atmospheric gravity waves in the D-region ionosphere are presented. Spectral analysis of the wave interaction data indicated that the presence of waves with periods ranging from tens of minutes to a few hours are possible. Critical intercomparison of two independently-developed electron-density profile inversion techniques are presented. The results showed that the two methods led to similar profiles indicating their reliability in profile inversion. Finally, temporal variations in D-region electron densities are presented showing diurnal variations as well as the variability between normal and anomalous conditions. Author (GRA)

N77-29677# Parke Mathematical Labs., Inc., Carlisle, Mass.
ANALYSIS AND SYNTHESIS OF MODEL IONOGRAMS USING 3D RAY TRACKING TECHNIQUES Final Report, Aug. 1975 - Oct. 1976
Barbara Langworthy, Theodore Barrett, Dean Bandes, and Lorenzo Calabi Griffiss AFB, New York RADC Feb. 1977 355 p refs
(Contract F19628-76-C-0029; AF Proj. 5631)
(AD-A038869; RADC-TR-77-60) Avail: NTIS HC A16/MF A01 CSCL 20/14

A system of digital computer programs for use with the Jones-Stephenson ray trace program is described. Using these programs it is possible to: (1) Produce complex ionospheres with simple input techniques; (2) Trace rays through very large ionospheres by the use of disk storage and word packing techniques; (3) Calculate power loss due to absorption, spreading, backscatter, and antenna patterns; (4) Produce leading edge ionograms, a dominant feature of full backscatter ionograms; (5) Produce probable model ionosphere parameters from information obtained from the leading edge ionograms; and (6) Produce many forms of ray trace information displays including various synthesized backscatter ionograms. Author (GRA)

N77-29678# Denver Univ., Colo. Dept. of Physics and Astronomy.
ION SAMPLING THROUGH SMALL ORIFICES AS RELATED TO STRATOSPHERIC MEASUREMENTS Final Report, 15 Dec. 1975 - 14 Dec. 1976
Bert Ivanzyl, David G. Murcray, and Robert C. Amme Mar. 1977 44 p refs
(Grant DAAG27-76-G-0122)
(AD-A038938; ARO-13633.1-GSX) Avail: NTIS HC A03/MF A01 CSCL 04/1

An experimental laboratory apparatus has been assemblied to study the problem of sampling of low density ions from the stratosphere. The ion sampling efficiency was found not to depend strongly on the sampling orifice configuration or material of construction, and scaled in proportion to the orifice area. A model including the effects of ion diffusion to the sampling orifice plate is suggested to account for the low sampling efficiency observed. The apparatus was also used to develop an ion optical lens system for for use in a stratospheric ion measurement package. Author (GRA)

N77-29679# Air Force Geophysics Lab., Hanscom AFB, Mass. Optical Physics Div.
SATELLITE TEMPERATURE SOUNDING OF THE ATMOSPHERE: GROUND TRUTH ANALYSIS
Robert A. McClatchey 19 Nov. 1976 40 p refs
(AF Proj. 7670)
(AD-A038236; AFGL-TR-76-0279; AFGL-AFSG-356) Avail: NTIS MF A01 CSCL 04/2

Defense Meteorological Satellite measurements of the upwelling radiation in the sounder channels of the 15 micrometer CO2 band have been compared with calculations for a number of clear atmospheric conditions. Great care was used to ensure

that complete radiosonde and rocketsonde data coincident in space and time were available. The methods of transmittance and radiance calculations are described and the results compared directly with the satellite measurements. The results indicate a systematic discrepancy in all but one channel. Calculations in general exceeded the measured radiances. Author (GRA)

N77-29680# Aerospace Corp., El Segundo, Calif. Ivan A. Getting Labs.
SPACE POWER SYSTEMS: WHAT WILL BE THEIR IMPACT ON THE UPPER ATMOSPHERE AND IONOSPHERE
Barbara K. Ching 8 Apr. 1977 30 p refs
(Contracts F04701-76-C-0077; F04701-75-C-0076)
(AD-A038924; TR-0077(2960-04)-2; SAMSO-TR-77-74) Avail: NTIS HC A03/MF A01 CSCL 04/1

Space power systems are currently receiving widespread attention because of the significant contributions that they could make toward meeting our country's energy needs in the 21st century. Although the systems are environmentally 'clean', relative to alternative or complementary concepts, some effects may be produced in the earth's atmosphere and ionosphere that could ultimately have an impact on other activities of our society and on the biosphere as a whole. Specifically, we must consider (1) interactions of the microwave radiation with the thermosphere and ionosphere, and (2) pollution of the entire atmosphere up through the thermosphere as a result of the high volume of space traffic that will be required to construct and then service and maintain the power satellites. Microwave propagation effects could result in ionospheric modification that would have adverse effects on communications systems. Pollution effects, particularly in the stratosphere, could lead to changes in the spectral properties of ultraviolet radiation at the earth's surface, which would alter a number of biospheric processes. These factors must be taken into account in the design and development of space power systems so as to minimize their impacts. In addition, since the pollution problem is not unique to power satellites alone, a careful assessment of this problem is necessary taking into account all advanced space systems concepts that require a high level of support by space transportation vehicles. GRA

N77-29681# Panametrics, Inc., Waltham, Mass.
THE RELATIONSHIP BETWEEN POLAR CAP RIOMETER ABSORPTION AND SOLAR PARTICLES Final Report, 12 Nov. 1975 - 12 Jan. 1977
Bach Sellers and Frederick A. Hanser Apr. 1977 37 p refs
(Contract F19628-76-C-0106)
(AD-A039894; AFGL-TR-77-0077) Avail: NTIS HC A03/MF A01 CSCL 04/1

A detailed investigation of the approximate square-root relationship between riometer absorption and solar proton fluxes has been carried out. The relationship is shown to be valid for night as well as day conditions, with differences in the constants. The atmospheric chemistry basis for the differences in the constants is discussed. Author (GRA)

N77-29682# New Mexico Univ., Albuquerque. Civil Engineering Research Facility.
STATISTICAL ESTIMATIONS OF GEOLOGICAL MATERIAL MODEL PARAMETERS FROM CYLINDRICAL IN-SITU TEST DATA Final Report
Jerrold Isenberg, John D. Collins, and Bruce Kennedy Mar. 1977 42 p refs Prepared in cooperation with J. H. Wiggins Co., Redondo Beach, Calif.
(Contract F29601-76-C-0015)
(AD-A039184; AFWL-TR-76-187) Avail: NTIS HC A03/MF A01 CSCL 08/13

A developmental study was performed to aid in the identification of soil properties from cylindrical in situ tests (CIST) data. A mathematical algorithm was developed which, using prior estimates of the properties and velocity-time history data from the tests, provided improved estimates of the parameters in the soil model. The algorithm was tested using a computational experiment, i.e., a finite-difference code was used to generate a set of velocity-time history responses based on a predetermined set of parameters. The algorithm was then used to determine a set of parameters based on the data, and comparisons were made with the exact solution. After a number of cycles through the algorithm, a set of parameters was derived which provided satisfactory matching of the velocity-time histories. GRA

N77-29683# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
A CANONICAL BREMMER SERIES DECOMPOSITION OF SOLUTIONS TO THE LOSSLESS WAVE EQUATIONS IN LAYERED MEDIA
Jerry M. Mendel Mar. 1977 13 p refs Presented at the 1977 Joint Autom. Control Conf., San Francisco, Jun. 1977
(Grant AF-AFOSR-2797-75; AF Proj. 2304)
(AD-A039573; AFOSR-77-0568TR) Avail: NTIS HC A02/MF A01 CSCL 08/11

In this paper, we prove the truth of the following decomposition of the solutions to the lossless wave equation in layered media; the complete output from a K-layer media system, which is comprised of the superposition of primaries, secondaries, tertiaries, etc., can be obtained from a single state space model of order 2K - the complete model - or from an infinite number of models, each of order 2K, the output of the first of which is just the primaries, the output of the second of which is just the secondaries, etc. This decomposition of the solution to the lossless wave equation into physically meaningful constituents (i. e., primaries, secondaries, etc) is called a canonical Bremmer Series decomposition, after Bremmer, who in 1951 established a similar decomposition. Author (GRA)

N77-29684# Dugway Proving Ground, Utah.
A STATISTICAL METHOD OF CALCULATING TURBULENCE VALUES FOR THE PASQUILL STABILITY CATEGORIES
Albert W. Waldron, Jr. 1977 43 p refs
(DA Proj. 1T0-62111-PH71)
(AD-A040127; DPG-TR-M-945A) Avail: NTIS HC A03/MF A01 CSCL 04/1

This paper demonstrates the feasibility of estimating vertical and horizontal turbulence values from wind speed and vertical temperature gradient. It is shown that daytime solar angle is highly correlated with vertical temperature gradient. Vertical temperature gradient is also correlated with measured net radiation. At night, vertical temperature gradient is correlated with net radiation and wind speed. Bulk Richardson's number can be calculated from vertical temperature gradient and wind speed. Monin-Obukhov length scale can be calculated from bulk Richardson's number. It is shown from Kansas Windy Acres data that horizontal and vertical turbulence can be estimated from surface roughness, Monin-Obukhov length scale and wind speed. Hence turbulence values can be assigned for each vertical temperature gradient, wind speed combination. The associated Pasquill category can be determined from turbulence values. Author (GRA)

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N77-29685 State Univ. of New York, Albany.
NUMERICALLY SIMULATED CLOUD INTERACTIONS AND FEEDBACK PROCESSES IN THE TRADE WIND ZONES Ph.D. Thesis
Zon-hwa Grace Feng 1976 137 p
Avail: Univ. Microfilms Order No. 77-8628

Comparisons between two cumulus cloud models in two-dimensional space for non-precipitating cases are presented. One model (nonparameterized) includes the complete microphysics such as nucleation, condensation and stochastic coalescence. The other is a bulk physical model using Kessler's parameterization scheme for the moist stage. Both models give similar but not identical results. A modified formula for the amount of released latent heat in the parameterized model is used in order to implicitly include the effect of supersaturation. This makes the results from the two models nearly identical. The applicability of Kessler's parameterization scheme for the study of a multicloud convective field was confirmed in the study reported. Dissert. Abstr.

N77-29686 Florida State Univ., Tallahassee.
INITIAL STATE ERRORS AND PROBABILITY PREDICTIONS OF ERRORS IN QUANTITATIVE PRECIPITATION FORECASTS Ph.D. Thesis
Preston Woodrich Leftwich, Jr. 1976 148 p
Avail: Univ. Microfilms Order No. 77-8600

A statistical-dynamical method of obtaining theoretical minimum variances of prediction errors resulting from synoptic analysis errors in initial data was applied to quantitative precipitation forecasts. Predictions for periods up to 36 hours were made with a two-level, quasi-geostrophic, baroclinic model using real data from three case studies. By means of a network sampling theory, theoretical minimum variances of observed atmospheric variables were computed. Theoretical probabilities that predicted values were within specified intervals of true values, were readily computed by assuming Gaussian distributions for prediction errors. Because only initial synoptic analysis errors were considered, theoretical probabilities were regarded as upper limiting probabilities of success in predictions made with the given dynamic model. Dissert. Abstr.

N77-29687 Colorado State Univ., Fort Collins.
DISPERSION IN A MOUNTAIN ENVIRONMENT Ph.D. Thesis
John Edward Digby Reid 1976 167 p
Avail: Univ. Microfilms Order No. 77-6810

Field tracer experiments were conducted with AgI seeding agent released from valley based generators and sensed with an acoustical ice nucleus counter aboard an NCAR Queenair-aircraft. The majority of experimental tracer days showed greater low-level stability than is typical for orographic cloud conditions. Under these circumstances the seeding agent is strongly constrained in the valley and frequently found to be transported considerable distances by low-level draingage flow. Thus transport of the seeding agent far upwind of the generator site as well as downwind is possible. Presence of an orographic cloud inhibits drainage flow on the shallower slopes leading to zones of low level flow convergence and forced vertical motions near marked terrain slope changes. This apparently provides one mechanism for seeding agent vertical transport during orographic conditions. Dissert. Abstr.

N77-29688*# Management and Technical Services Co., Beltsville, Md.
THE NIMBUS 6 DATA CATALOG. VOLUME 1: 12 JUNE 1975 THROUGH 31 AUGUST 1975. DATA ORBITS 1 THROUGH 1082
Nov. 1975 307 p
(Contract NAS5-20694)
(NASA-CR-154279) Avail: NTIS HC A14/MF A01 CSCL 04B

Subsections 1.2 through 1.10 of this catalog summarize the operational highlights of the individual experiments, present preliminary experiment results, and call attention to known data anamolies. Section 2 lists the on-off times for each experiment and provides a method for determining the geographical coverage of each experiment. Section 3 shows selected HIRS, SCAMS and ESMR images, and Section 4 presents THIR montages. Section 5 presents corrections to The Nimbus 6 User's Guide. Author

N77-29689*# Management and Technical Services Co., Beltsville, Md.
THE NIMBUS 6 DATA CATALOG. VOLUME 2: 1 SEPTEMBER 1975 THROUGH 31 OCTOBER 1975. DATA ORBITS 1083 THROUGH 1900
Jan. 1976 349 p
(Contract NAS5-20694)
(NASA-CR-154281) Avail: NTIS HC A15/MF A01 CSCL 04B

For abstract, see N77-29688.

N77-29690*# Management and Technical Services Co., Beltsville, Md.
THE NIMBUS 6 DATA CATALOG. VOLUME 3: 1 NOVEMBER 1975 THROUGH 31 DECEMBER 1975. DATA ORBITS 1901 THROUGH 2717
Feb. 1976 360 p refs
(Contract NAS5-20694)
(NASA-CR-154280) Avail: NTIS HC A16/MF A01 CSCL 04B

For abstract, see N77-29688.

N77-29691*# Management and Technical Services Co., Beltsville, Md.
THE NIMBUS 6 DATA CATALOG. VOLUME 4: 1 JANUARY 1976 THROUGH 29 FEBRUARY 1976. DATA ORBITS 2718 THROUGH 3521
Apr. 1976 355 p
(Contract NAS5-20694)
(NASA-CR-154282) Avail: NTIS HC A16/MF A01 CSCL 04B

For abstract, see N77-29688.

N77-29692*# Management and Technical Services Co., Beltsville, Md.
THE NIMBUS 6 DATA CATALOG. VOLUME 5: 1 MARCH 1976 THROUGH 30 APRIL 1976. DATA ORBITS 3522 THROUGH 4338
Dec. 1976 360 p
(Contract NAS5-23740)
(NASA-CR-154283) Avail: NTIS HC A16/MF A01 CSCL 04B

For abstract, see N77-29688.

N77-29693# National Aviation Facilities Experimental Center, Atlantic City, N. J.
SLANT AND RUNWAY VISUAL RANGE RELATIONSHIPS Final Report, Jul. 1975 - Jun. 1976
William Lewis and Ernest E. Schlatter Jun. 1977 30 p refs (AD-A041134; FAA-NA-76-50; FAA-RD-77-34) Avail: NTIS HC A03/MF A01 CSCL 04/2

The implications of the various fog structures for aircraft landings are discussed. Average 5- to 155-foot slant visual range versus 5-foot runway visual range (SVR-RVR) ratios and standard deviations of ratios were computed by profile class. An analysis showed that results are definitive and could form the basis of a procedure for estimating SVR from RVR through fog profile measurement. A multiple linear regression analysis to predict SVR from RVR, surface temperature, windspeed, and atmospheric stability showed RVR to be the best predictor of SVR, while the other variables showed some effect only with dense fog. These results are considered tentative, since they are based on a limited data sample. Fifteen-minute changes in SVR by profile class were examined for certain SVR ranges. Results showed that knowledge of the profile class would not significantly improve 15-minute persistence forecasts of SVR. Author

N77-29694# Battelle Pacific Northwest Labs., Richland, Wash.
WIND SHEAR DOWNWIND OF LARGE SURFACE ROUGHNESS ELEMENTS
J. V. Ramsdell Aug. 1976 22 p refs Presented at 7th Conf. on Aerospace and Aeron. Meteorol., Melbourne, Fla., 16 Nov. 1976
(Contract E(45-1)-1830)
(BNWL-SA-5840) Avail: NTIS HC A01/MF A01

The variations of the vertical and lateral shear of the longitudinal component of the wind are described. Data on the fluctuations of the vertical and lateral shears of the longitudinal wind component near the Seattle, Washington, central business district have been analyzed to determine shear characteristics downwind of large roughness elements. The analysis has examined the frequency distributions and time scales of the shear fluctuations. When possible the results were compared with results of analysis of data from Cape Kennedy, Florida. ERA

N77-29695# Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.
METEOROLOGICAL DATA, SERIES B BASIC MATERIAL. VOLUME 10, NO. 1: THE EUROPEAN CLIMATOLOGY 1976. WEATHER SATELLITE DATA FROM THE BERLIN RECEIVING AREA, PART 1 Quarterly Report, 1 Jan. - 31 Mar. 1976 [METEOROLOGISCHE ABHANDLUNGEN, SERIE B GRUNDLAGENMATERIAL. BAND 10, HEFT 1: DAS EUROPAEISCHE WETTERBILD 1976. WETTERSATELLITENDATEN AUS DEM BERLINER EMPFANGSBEREICH. TEIL 1,

1. VIERTELJAHR, 1. JANUAR BIS 31. MAERZ 1976]
Verlag von Dietrich Reimer 1976 219 p refs In GERMAN
(QR-1-Pt-1) Avail: NTIS HC A10/MF A01

Daily European weather pictures are presented for the first quarter of 1976. These are based on the scanning radiometer data, in the visible and infrared range, received from the NOAA 4 satellite during its north-south passes over Europe. The processing of satellite pictures based on their statistical data is examined. ESA

N77-29696# Cologne Univ. (West Germany). Inst. fuer Geophysik und Meteorologie.
NUMERICAL SIMULATION OF GRAUPEL FORMATION [NUMERISCHE SIMULATION DER GRAUPELBILDUNG]
K. D. Beheng Dec. 1976 69 p refs In GERMAN; ENGLISH summary
(Mitt-23) Avail: NTIS HC A04/MF A01

The time-dependent formation of graupels by freezing of undercooled cloud droplets on plate-like ice crystals and, simultaneously, the development of the distribution of the remaining cloud droplets were simulated numerically in terms of stochastic collection equations. The initial Gaussian ice crystals distributions depends on the ice crystal concentration, and on the mean value of the radius of the a-axis of the ice crystals. The cloud droplet distribution is the same as used by Berry and Reinhardt (1974). The freezing of undercooled droplets is assumed to depend on the characteristic ice nuclei concentration of the droplets, calculated with the theory of Valt (1971), and under consideration of droplet freezing experiments. The collection-kernel of the interaction graupel-droplet was estimated assuming spherical symmetry of both the graupel and the droplet. For the collection-kernel of the interaction of the ice crystals with droplets, values after Pitter and Pruppacher (1974) were considered. The interaction of many large ice crystals with the cloud droplets results in small graupels in up to 400 sec. On the other hand a few small ice crystals develop in large graupels in more than 600 sec. In these periods the liquid water content decreases. The sizes of the graupels are in good agreement with observational data. The time-dependent imbedding of the ice crystals in the system creates no difference in the sizes of the graupels, but the distribution becomes narrower if the time constant is short. The growth of large droplets by coalescence is reduced considerably. Only a slow decrease of the liquid water content produces droplets with radii greater than 100 micron.
Author (ESA)

N77-29697# Royal Netherlands Meteorological Inst., De Bilt.
THE QUALITY OF 3-DAY FORECASTS BASED ON SEVERAL OBJECTIVE METHODS [ONDERZOEK NAAR DE KWALITEIT VAN 3-DAAGSE VERWACHTINGEN OPGESTELD M.B.V. VERSCHILLENDE OBJECTIEVE METHODEN]
J. P. deJongh 1977 23 p refs In DUTCH
(KNMI-V-283) Avail: NTIS HC A02/MF A01

The application of an objective method to the forecasting of three weather elements was analyzed and results compared to those predicted by meteorologists. Two objective methods were used: linear discriminant analysis and the analog method. The objective sunshine forecast for day 3 according to the analog method was found to be better than that forecast by meteorologists. The objective precipitation forecast for day 3 according to the analog method and the discriminant analysis have the same quality as 3-day meteorologist forecasts. Similar accuracy was found for maximum temperature. None of the objective methods are accurated enough for 1-day forecasts. ESA

N77-29698# World Meteorological Organization, Geneva (Switzerland).
THE FIRST PLANNING MEETING FOR THE WEST AFRICAN MONSOON EXPERIMENT (WAMEX) Global Atmospheric Research Program
1977 44 p refs Conf. held at Dakar, Senegal, 29 Nov. - 3 Dec. 1976 Prepared jointly with ICSU, Rome
(GARP-Spec-Rept-23) Avail: NTIS HC A03/MF A01; WMO, Geneva

Following details of the organization of the session, the scope of the West African Monsoon Experiment (WAMEX) and a review of its scientific objectives are given. The observing system is described together with the data management system. The organization of the management mechanism for WAMEX is discussed and a statement of possible national contributions given. ESA

N77-29699# World Meteorological Organization, Geneva (Switzerland).
THE FOURTH SESSION OF WMO EXECUTIVE COMMITTEE INTER-GOVERNMENTAL PANEL ON THE FIRST GARP GLOBAL EXPERIMENT
1977 116 p Conf. held at Geneva, Feb. 1977 Prepared jointly with ICSU, Rome
(GARP-Spec-Rept-24) Avail: NTIS HC A06/MF A01; WMO, Geneva

Following details on the organization of the session and the present status of commitments and level of implementation of the global experiment a summary of the implementation operation of the plan is given. The other programs making up the experiment are reviewed and future actions are noted. ESA

N77-29700# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.
NUMERICAL EXPERIMENTS WITH A NEW SPECTRAL MODEL OF THE GLOBAL ATMOSPHERIC CIRCULATION Ph.D. Thesis - Free Univ. Berlin
Wilfried Niesen 1977 44 p refs In GERMAN; ENGLISH summary
(DLR-FB-77-02) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 15.90

Tests were carried out of an atmospheric circulation model based on the one developed by Alyea (1972). Alyea's model is that global harmonics are used. The nonlinear terms are also treated in a different way. Before multiplication they are transformed to gridpoints, are then multiplied and transformed back. Storage and computer time is hereby reduced. Two other differences are: triangular instead of rhomboidal truncation and use of an N-cycle scheme for time derivatives instead of a leapfrog scheme. Maximum wave number is variable and can be changed up to 16 waves. During time integrations all values are in form of coefficients and therefore continuous in space. If physical values are desired, a transforming routine transforms those values to gridpoints from 5 to 5 deg. Results in form of values for kinetic energy as well as vorticity and potential temperature are discussed. Author (ESA)

N77-29701# Alaska Univ., College. Geophysical Inst.
ARCTIC RADIATION FLUXES: THE LONG WAVE RADIATION TRANSFER IN ARCTIC STRATUS CLOUDS Final Report, 1 Jan. 1976 - 30 Sep. 1977
K. O. L. F. Jayaweera Apr. 1977 27 p refs
(Contract N00014-75-C-0433)
(AD-A038272) Avail: NTIS HC A03/MF A01 CSCL 04/2

Stratus cloud cover over Barrow, Aidjex Camp 'Big Bear' and over the Beaufort Sea was derived for 1975 using surface and satellite observations. Contrary to the reported value of the consistently high long term summer mean cloudiness, the values for 1975 showed a period of complete lack of cloudiness. Comparison with the wind field suggests that a southerly component in the 700 mb winds corresponds to an increase in cloudiness and a northerly component corresponds to a decrease. The unusual northerly 700 mb flow during this year may explain both the low summer cloudiness and the severe ice conditions in the Beaufort Sea. The temperature and emissivity profiles measured using instrumented aircrafts indicated that within a few days of formation of stratus cloud overcast, the emissivity at the top part of cloud becomes low and the temperature inversion drops down to the middle part of the cloud. Continuous solar heating and the effect of scattering in the long wave may be responsible for these changes. Author (GRA)

N77-29702# Air Force Geophysics Lab., Hanscom AFB, Mass. Meteorology Div.
ATLAS OF PROBABILITIES OF SURFACE TEMPERATURE EXTREMES. PART 2: SOUTHERN HEMISPHERE Final Report
Paul Tattelman and Arthur J. Kantor 27 Dec. 1976 28 p refs
(AF Proj. 8624)

(AD-A038237; AFGL-TR-77-0001-Pt-2; AFGL-ERP-588-Pt-2) Avail: NTIS HC A03/MF A01 CSCL 04/2

The method for calculating warm and cold temperature extremes, described in Part I for the Northern Hemisphere, is used in this report (Part II) for an analogous presentation in the Southern Hemisphere. A bias in the estimates of cold temperature extremes for the Southern Hemisphere is discussed and evaluated in this report, resulting in development of a new set of regression equations to depict cold temperature extremes. The resulting Southern Hemisphere maps of the 1-, 5-, and 10-percent warm temperatures, and the 1-, 5-, 10-, and 20-percent cold temperatures for the warmest and coldest months, respectively, are presented. Parts I and II of this report together provide a global representation of warm and cold surface temperature extremes for use in systems design and operation. Author (GRA)

N77-29703# Maryland Univ., College Park. Computer Science Center.

CLOUD CLASSIFICATION: EXPERIMENTAL EVALUATION

Jo Ann Parikh Mar. 1977 47 p refs

(Contract F44620-72-C-0062)

(AD-A038922; TR-514; AFOSR-77-0582TR) Avail: NTIS HC A03/MF A01 CSCL 04/2

In a previous report (AD-A033 037), a comparative study of statistical cloud classification techniques for discriminating scanning radiometer visible and infrared tropical cloud data was described. The present report explores the effects on classification performance of changes in the satellite, the location and time of observations, the sample window size, and the testing procedure (i.e., testing on a data set different from the design set). Author (GRA)

N77-29704# Oregon Graduate Center for Study and Research, Beaverton. Dept. of Applied Physics and Electronic Science.

EXPERIMENTAL PULSED LASER REMOTE CROSSWIND MEASUREMENT SYSTEM. PART 4: FEASIBILITY STUDY AND DESIGN Interim Report, 15 Oct. 1975 - 14 Nov. 1976

J. Fred Holmes, J. Richard Kerr, Myung H. Lee, and Michael E. Fossey 14 Nov. 1976 77 p refs

(Contract DAAA25-76-C-0132)

(AD-A038638; FA-TR-76065-Pt-4) Avail: NTIS HC A05/MF A01 CSCL 04/2

Recent activity with regard to development of a pulsed laser, remote crosswind measurement system is described. This includes a more complete theoretical formulation which includes the log-amplitude perturbation. In addition, CW experimental work used to verify the theoretical formulation and the design and construction of a new pulsed crosswind system are described. The system uses a double pulsed 1.06 micrometer Nd:YAG laser, a sixteen element arrayed receiver and space-time statistical averaging. Author (GRA)

N77-29705# Range Commanders Council, White Sands Missile Range, N. Mex. Meteorological Group.

METEOROLOGICAL DATA ERROR ESTIMATES Final Report

Jan. 1977 26 p refs Supersedes IRIG-MWG-110-71

(AD-A038788; MG-110-77; IRIG-MWG-110-71) Avail: NTIS HC A03/MF A01 CSCL 04/2

This document was originally published in 1965 as IRIG Document 110-64, Meteorological Equipment Data Accuracies, and again in 1971 as RCC Document 110-71, Reliability of Meteorological Data. The latter title has been largely misunderstood. Therefore, for somewhat more ease of application, this edition of the document contains error estimates of meteorological data in statistical form. Author (GRA)

N77-29706# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.

REMOTE WIND MEASUREMENT IN FOG USING LASER DOPPLER VELOCIMETRY Final Report, 1 Jul. - 31 Dec. 1976

H. R. Brashears and W. R. Eberle Dec. 1976 261 p refs

(Contract F19628-76-C-0237)

(AD-A038514; LMSC-HREC-TR-D497127; AFGL-TR-76-0313) Avail: NTIS HC A13/MF A01 CSCL 04/2

A Laser Doppler Velocimeter is an instrument for remote sensing of atmospheric wind. This report describes a test designed to validate the ability of the Laser Doppler Velocimeter to measure winds in fog. The test instrument was placed at Otis AFB for a test period of one month. It was operated during conditions of fog during the test period. Three-dimensional wind components were generated using three distinct computational algorithms. A description of the Laser Doppler Velocimeter and computational algorithms are presented. Wind measurement results and a discussion of those results are also given. Because the Laser Doppler Velocimeter used for the test is a research instrument, recommendations are made for improvement for a system designed to remotely measure winds in fog. Author (GRA)

N77-29707# Fleet Weather Central/Joint Typhoon Warning Center, FPO San Francisco, Calif. 96630.

TYPHOON REPORT, 1976 Annual Report, Jan. - Dec. 1976

1976 99 p

(AD-A038484) Avail: NTIS HC A05/MF A01 CSCL 04/2

This annual publication summarizes the tropical cyclone season in the western North Pacific, the North Indian Ocean, and the central North Pacific. A brief narrative is given on each typhoon in the western North Pacific including the best track. Forecast verification data and statistics for JTWC are summarized. Research efforts at JTWC are discussed briefly. Author (GRA)

N77-29708# Air Force Environmental Technical Applications Center, Scott AFB, Ill.

REFORGER 77 SUPPORT. PART A: AN INDEPENDENT TEST OF THE REFORGER 76 SUPPORT CLIMO PROGRAM

Murray J. Young Jan. 1977 18 p

(AD-A040093; USAFETAC-8065A) Avail: NTIS HC A02/MF A01 CSCL 04/2

The maximum difference between a modeled climatology and the observed climatology is used to determine whether the modeled and observed are the same. Statistically, significant differences were found, suggesting further development and study are needed. Author (GRA)

N77-29709# Air Force Environmental Technical Applications Center, Scott AFB, Ill.

EXTREME WINDS AND THEIR VERTICAL PROFILE AT SLC-6 LAUNCH PAD, VANDENBERG AFB, CALIFORNIA

Tamzy J. Cunningham Feb. 1977 21 p

(AD-A040094; USAFETAC-8234) Avail: NTIS HC A02/MF A01 CSCL 04/2

The study of extreme winds and their vertical profile at SLC-6 launch pad, Vandenberg AFB, CA was conducted to aid in the determination of wind loadings for the launch pad complex. Data sets from micromet wind Towers 300 and 301 were used in the analysis. Results from the extreme-value statistics indicate that winds greater than 60 kt will most likely occur at the launch site in a 10-year return period during the winter season from the south and east. For winds less than 40 kt the vertical wind profile was generally explained by the turbulent boundary layer power-law profile equation. Winds greater than 40 kt overcame the effect of surface friction resulting in excessive winds at all levels. Author (GRA)

N77-29710# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.

AUTOMATED PROCESSING OF SATELLITE IMAGERY DATA AT AIR FORCE GLOBAL WEATHER CENTRAL (AFGWC): DEMONSTRATIONS OF SPECTRAL ANALYSIS Final Report, 1 Jan. 1976 - 30 Apr. 1977

Elliot S. Blackman and Ronald M. Pickett Mar. 1977 33 p refs

(Contract F19628-76-C-0124)

(AD-A039918; BBN-3521; AFGL-TR-77-0080) Avail: NTIS HC A03/MF A01 CSCL 04/2

This document is the final report of a one year program of work concerned with finding ways to upgrade automated processing of Defense Meteorological Satellite Program (DMSP) imagery data at Air Force Global Weather Central (AFGWC). In the first of two states of work, surveys were conducted to identify needs for imagery processing at AFGWC and to find

the best technique for AFGWC to adopt next in upgrading its capability for automated imagery processing. The procedure and results of the first stage, including the recommendation that spectral analysis be adopted for improved feature abstraction in the current 3 DNEPH program, are separately reported. The procedure and results of Stage 2, which focused on demonstrations and checks of spectral analysis on selected DMSP imagery samples, are presented here along with a summary of conclusions and recommendations from the contract effort as a whole.
Author (GRA)

N77-29711# Florida State Univ., Tallahassee. Dept. of Statistics.
AN INTERPRETIVE HISTORY OF THIRTY-YEARS (1945-1975) OF WEATHER MODIFICATION
Charles Lester Bach Mar. 1977 113 p refs
(Contract N00014-76-C-0394)
(AD-A039669; FSU-Statistics-M410; TR-112-ONR) Avail: NTIS HC A06/MF A01 CSCL 04/2

The development of the physical understanding of weather modification and the evolution of statistical and meteorological design criteria for weather modification experiments for the 30-year period (1945-1975) are investigated. Also, social, economic, and legal problems of weather modification are discussed as they affect the above. Graphs are constructed depicting the chronology of reported articles on storm-system (in this paper 'storm-system' refers to attempts to increase rainfall from extratropical cyclones and organized systems of clouds), cold fog, warm fog, hail, and lightning modification. An attempt is made to explain the changes in the number of experiments reported during the description of the evolution of weather modification. The summary of the 30-year period of weather modification is for three 10-year periods. The first decade is shown to be dominated by scientific innovations and disputes. The second decade featured initiation of efforts by meteorologists and statisticians at ending the controversies of the first 10 years. The third decade was marked by increased exchanges of ideas and results of weather modification operations at conferences and symposia and serious investigation into social, economic, and legal ramifications of weather modification. Author (GRA)

N77-29712# Massachusetts Inst. of Tech., Cambridge.
STATIC AND DYNAMIC CALIBRATION OF A CORONA DISCHARGE ANEMOMETER Final Report, Apr. - Dec. 1976
Frank H. Durgin and Jerome P. Fanucci Dec. 1976 72 p
(Contract F19628-76-C-0145)
(AD-A040038; WBWT-TR-1101; AFGL-TR-77-0022) Avail: NTIS HC A04/MF A01 CSCL 04/2

A Corona Discharge Anemometer (CDA) which is to be used in some balloon experiments designed to measure clear air turbulence, was tested. First a modified version of the anemometer commercially was tested statically to determine its sensitivity, its ability to resolve the x and y components of velocity, and the effect of out of plane flow on its sensitivity. GRA

N77-29713# North American Weather Consultants, Goleta, Calif.
A STUDY OF STRATUS CLOUDS IN CENTRAL EUROPE Final Report, 18 Nov. 1975 - 15 Jan. 1977
C. Wisner and Leona N. Shaffer 19 Jan. 1977 63 p
(Contract F19628-76-C-0097)
(AD-A040037; AFGL-TR-77-0021) Avail: NTIS HC A04/MF A01 CSCL 04/2

Surface and rawinsonde observations from six locations in Central Europe were analyzed for the presence of stratus layers. Cloud height, depth, temperature, and stability were determined for each layer. Wind speed and shear associated with each layer were also determined. These data were recorded on magnetic tape and are summarized in detail elsewhere. This report documents the procedures used to produce the tapes and the detailed analysis. It also provides a broad overview of the results of this analysis. Author (GRA)

N77-29714# National Center for Atmospheric Research, Boulder, Colo.
NATIONAL HAIL RESEARCH EXPERIMENT RANDOMIZED SEEDING EXPERIMENT 1972-1974. VOLUME 1: EXPERIMENTAL RESULTS AND OVERALL SUMMARY Final Report
E. L. Crow, P. W. Summers, A. B. Long, C. A. Knight, and G. B. Foote Dec. 1976 277 p refs
(Contract NSF C-760)
(PB-266196/5; NCAR-7100-76/6-Vol-1) Avail: NTIS HC A13/MF A01; also available in set of 5 reports PCE18, PB-266195-SET CSCL 04B

The primary statistical analysis of the hail and rain in the target area are reviewed, as well as ancillary analyses using various stratifications obtained from model results, storm characteristics, and the consistency and accuracy of seeding coverage. Possible responses of the storms to seeding are also sought in daily time and area integrations of the radar reflectivity data and in the analysis of hailstone embryo structure. GRA

N77-29715# National Center for Atmospheric Research, Boulder, Colo.
NATIONAL HAIL RESEARCH EXPERIMENT RANDOMIZED SEEDING EXPERIMENT 1972-1974. VOLUME 2: PRECIPITATION MEASUREMENTS Final Report
J. E. Dye, A. J. Heymsfield, I. Paluch, and D. W. Breed Dec. 1976 538 p refs
(Contract NSF C-760)
(PB-266197/3; NCAR-7100-76/6-Vol-2) Avail: NTIS HC A23/MF A01; also available in set of 5 reports PCE18, PB-266195-SET CSCL 04B

A precipitation summary is considered that describes all of the instruments, network operation, network differences from year to year, editing procedures used to preprocess the raw data, and the limitations of the data. The extensive tabulation of data includes station totals of rain for each site for each day. The hail size distribution is listed for each hailpad, and maps showing the areal distribution of rain and hail for each day are given.
GRA

N77-29716# National Center for Atmospheric Research, Boulder, Colo.
NATIONAL HAIL RESEARCH EXPERIMENT RANDOMIZED SEEDING EXPERIMENT 1972-1974. VOLUME 3: METEOROLOGICAL SUMMARY Final Report
J. C. Fankhauser, A. C. Modahl, C. G. Mohr, and M. E. Solak Dec. 1976 317 p refs
(Contract NSF C-760)
(PB-266198/1; NCAR-7100-76/6-Vol-3) Avail: NTIS HC A14/MF A01; also available in set of 5 reports PCE18, PB-266195-SET CSCL 04B

Volume III discusses the synoptic meteorology attending the convective development on each of the 57 declared hail days over the three-year period and presents the results of a study aimed at deriving soundings that are representative of the environment on each of the days. GRA

N77-29717# National Center for Atmospheric Research, Boulder, Colo.
NATIONAL HAIL RESEARCH EXPERIMENT RANDOMIZED SEEDING EXPERIMENT 1972-1974. VOLUME 4: RADAR SUMMARY Final Report
G. B. Foote, R. C. Srivastava, J. C. Fankhauser, F. I. Harris, and T. J. Kelly Dec. 1976 332 p refs
(Contract NSF C-760)
(PB-266199/9; NCAR-7100-76/6-Vol-4) Avail: NTIS HC A15/MF A01; also available in set of 5 reports PCE18, PB-266195-SET CSCL 04B

The radar system and radar observations on each of the hail days are described. Characteristics of more than 900 convective cells are documented, and maps showing the envelopes of low level PPI echo contours are also included.GRA

N77-29718# National Center for Atmospheric Research, Boulder, Colo.
NATIONAL HAIL RESEARCH EXPERIMENT RANDOMIZED SEEDING EXPERIMENT 1972-1974. VOLUME 5: HAIL DECLARATION PROCEDURES AND SEEDING OPERATIONS Final Report
R. W. Sanborn, J. C. Fankhauser, G. B. Foote, C. A. Knight, G. Langer, C. J. Biter, T. J. Kelly, R. E. Rinehart, M. E. Solak, P. W. Summers et al Dec. 1976 215 p refs
(Contract NSF C-760)

(PB-266200/5; NCAR-7100-76/6-Vol-5) Avail: NTIS HC A10/MF A01; HC also available in set of 5 reports as HC 18, PB-266195-SET CSCL 04B

The actual conduct of the seeding operations and an evaluation of how well each storm was seeded are described. The characteristics of the seeding agents employed are also presented. GRA

N77-29719# National Oceanic and Atmospheric Administration, Miami, Fla. Atlantic Oceanographic and Meteorological Labs.
SURFACE METEOROLOGICAL OBSERVATIONS ON R/V COLUMBUS ISELIN DURING PHASE 3 OF GATE
Feodor Ostapoff, Sylvia Worthem, and William Everard Jan. 1977 132 p
(PB-266038/9; NOAA-TM-ERL-AOML-25; NOAA-77031803) Avail: NTIS HC A07/MF A01 CSCL 04B

The surface meteorological instrumentation used during the third phase of GATE aboard the R/V COLUMBUS ISELIN is described. The ship track, surface meteorological observations, and the calculated momentum and heat fluxes are presented. The procedure for calculating the fluxes is described. GRA

N77-29720# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
PERFORMANCE TEST RESULTS FOR A XONICS ACOUSTIC DOPPLER SOUNDER
Duane A. Haugen May 1976 19 p
(PB-263954/7; NOAA-TM-ERL-WPL-16; NOAA-77041313) Avail: NTIS HC A02/MF A01 CSCL 04B

Tests were performed about 10 miles north of Boulder, Colorado. Wind speeds observed ranged from 0 to 10 m/s at 2.5 m and 0 to 20 m/s at 148 m. Rain occurred only once during the two month period in the form of a light drizzle. Data were obtained under turbulence conditions ranging from nearly laminar thermally stable flow, to strong, gusty, thermally unstable flow. The shear or wind profile analysis indicates that shears are increasingly overestimated as the surface wind speeds exceed 4 m/s for the V component, but are well estimated for the U component, an indication that the final U receiver configuration was near optimum for these tests. The results of the tests are presented. GRA

N77-29721# National Weather Service, Silver Spring, Md. Techniques Development Lab.
OPERATIONAL SYSTEM FOR PREDICTING THUNDERSTORMS TWO TO SIX HOURS IN ADVANCE
Jerome P. Charba Mar. 1977 32 p refs
(PB-266969/5; NOAA-TM-NWS-TDL-64; NOAA-77040502) Avail: NTIS HC A03/MF A01 CSCL 04B

The probabilities are for square areas 40-45 nmi on a side which cover most of the United States east of the Rocky Mountains. The probabilities are produced by multiple linear regression equations. The independent variables or predictors in these equations are derived from routinely-observed surface atmospheric variables, manually digitized radar data, localized climatic frequencies of thunderstorms, and large-scale numerical model output. Predictor quantities computed from these data are appropriately positioned relative to the predictand areas and linearized in order to enhance their correlations with the predictand. GRA

N77-29722# National Environmental Satellite Service, Washington, D. C.
WINTER SNOW-COVER MAPS OF NORTH AMERICA AND EURASIA FROM SATELLITE RECORDS, 1966 - 1976
Michael Matson Mar. 1977 36 p refs
(PB-267393/7; NOAA-TM-NESS-84; NOAA-77041804) Avail: NTIS HC A03/MF A01 CSCL 04B

Weekly snow and ice cover charts of the Northern Hemisphere based on satellite data were averaged to create monthly mean snow cover maps of North America and Eurasia for the months of December through March 1966 - 1976. A ten year mean snow cover map for each winter month also was prepared. Included on each monthly mean winter snow-cover map is a month by month analysis of all ten years of data. GRA

N77-29723# National Environmental Satellite Service, Washington, D. C.
A RELATIONSHIP BETWEEN WEAKENING OF TROPICAL CYCLONE CLOUD PATTERNS AND LESSENING OF WIND SPEED
James B. Lushine Mar. 1977 20 p refs
(PB-267392/9; NOAA-TM-NESS-85; NOAA-77041805) Avail: NTIS HC A02/MF A01 CSCL 04B

A comparison between tropical cyclone intensity estimates from airborne reconnaissance data and from satellite photographs was made for all tropical systems in the North Atlantic Ocean, Caribbean Sea, and Gulf of Mexico for the results suggest that the Dvorak technique for estimating maximum surface winds in tropical cyclones be modified. It is recommended that the delay of 24 hours between cloud pattern weakening and the lessening of the estimated maximum surface wind speed currently in use be reduced to 12 hours. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N77-29724 California Univ., San Diego.
STATISTICAL HYDROMECHANICS: APPLICATIONS IN MESOSCALE OCEAN CIRCULATION Ph.D. Thesis
Greg Holloway 1976 132 p
Avail: Univ. Microfilms Order No. 77-8724

Theoretical methods are developed for predicting the statistical evolution of nonlinear dynamical equations. The methods follow from recent advances in turbulence theory, extended here to flows in which linear effects may compete with, or dominate over, nonlinear effects. We obtain closed single-time master equations for second moments of the flows. Principal applications are presented to nonlinear barotropic Rossby waves and to nonlinear barotropic flow over irregular bottom topography, direct numerical simulations of these flows are found to be in encouraging agreement with theoretical results. For very strong nonlinearity, the closure equations for Rossby waves limit on equations for turbulence in two-dimensional flow. Dissert. Abstr.

N77-29725 State Univ. of New York, Albany.
SUBSTORM-ASSOCIATED LONG-PERIOD HYDROMAGNETIC WAVES Ph.D. Thesis
Teresa Mung-Shiang Lee 1976 282 p
Avail: Univ. Microfilms Order No. 77-8632

The analysis of magnetograms recorded at selected N-S chain stations has shown the existence of long-period (30 min.-2.5 hr.) hydromagnetic waves at middle and low latitude stations prior to and/or simultaneous with the polar magnetic substorms. The amplitude of the wave is about 10 - 30 gammas. The most interesting feature of these long-period hydromagnetic waves appears to be the latitude independent of their eigenperiods. The simultaneous appearance of these waves at all low- and middle latitude stations in both hemispheres in all of the ten events suggests that these waves are predominated by poloidal mode and generated by the oscillations of a resonant cavity. The shorter period waves occurred prior to substorm and longer period waves that occurred simultaneously with substorm are suggested to be caused by the oscillations of the plasmasphere and the plasmasphere-tail-plasma sheet system, respectively. Dissert. Abstr.

N77-29726# Burk and Associates, Inc., New Orleans, La.
LOUISIANA COASTAL RESOURCE INVENTORY. VOLUME 1: GEOGRAPHIC AREAS OF PARTICULAR CONCERN
Jun. 1975 184 p refs Sponsored in part by Louisiana State Planning Office, Baton Rouge and NOAA, Washington D. C. Office of Coastal Zone Management
(PB-266504/0; NOAA-77021607) Avail: NTIS HC A09/MF A01 CSCL 13B

Recreational, historical, cultural, or archeological concern that might qualify for future preservation and designation as protected vital areas were mapped. Developed and pressured areas were also mapped to provide the basis for future delineation of areas of general use. Such areas may be suitable for intensive use and development if they have no significant ecological, recrea-

tional, or cultural importance. There is pervasive opinion among resource planning agencies that estuaries and surrounding wetlands are areas of environmental concern. It therefore does not take extensive study to conclude that Louisiana's estuaries are areas of environmental concern within which human activities must be carefully controlled, though not necessarily prohibited, in order to protect the environment. GRA

N77-29727# Burk and Associates, Inc., New Orleans, La.
LOUISIANA COASTAL RESOURCE INVENTORY. VOLUME 3: SIGNIFICANT COASTAL PLANS AND PROJECTS
Jun. 1975 72 p refs Sponsored in part by Louisiana State Planning Office, Baton Rouge and NOAA, Washington, D. C. Office of Coastal Zone Management
(PB-266505/7; NOAA-77021606) Avail: NTIS HC A04/MF A01 CSCL 13B

The coastal ecosystem support many and varied uses which provide the economic base of South Louisiana. At the same time, use of the coast's resources should not exceed the point where it seriously reduces its phenomenal productivity. Hopefully, the Coastal Resources Program will enable maximum utilization of the coast's vast resources, while at the same time protecting and conserving those areas most vital to the natural system. GRA

N77-29728# Harbridge House, Inc., New York.
EVALUATION OF THE INTERNATIONAL DECADE OF OCEAN EXPLORATION. A NATIONAL SCIENCE FOUNDATION RESEARCH PROGRAM Final Report
John D. Costlow (Duke Univ., Durham, N. C.), Dana R. Kester (Rhode Island Univ., Kingston), Frank T. Manheim (Univ. of South Florida) and Dennis S. Polis (Delaware Univ.), Nov. 1976 300 p refs
(Contract NSF C-1054)
(PB-265729/4; NSF/ES-77/1) Avail: NTIS HC A13/MF A01 CSCL 08J

The evaluation assesses the progress that each IDOE project has made toward accomplishing its objectives and the degree to which the results of projects have contributed or have the potential for contributing to the broad goals of the IDOE. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N77-29729*# Kanner (Leo) Associates, Redwood City, Calif.
IDENTIFICATION OF 180 MILLION YEARS OLD, PROBABLY UNCHANGED MELANINE
K. Beyermann and D. Hasenmaier Washington NASA Jul. 1977 10 p refs Transl. into ENGLISH from Z. fuer Anal. Chem. (Wiesbaden), vol. 266, 1973 p 202-205
(Contract NASw-2790)
(NASA-TM-75132) Avail: NTIS HC A02/MF A01 CSCL 06C

The comparison of the infrared spectra of recent sepia melanine and of the content of the ink sac of fossilized cuttlefish indicates that the 180 million years old substance is unchanged melanine. Both substances behave identically on heating. Other procedures for identification of melanine are surveyed critically. Author

N77-29730# Dornier-System G.m.b.H., Friedrichshafen (West Germany).
STUDY ON INCUBATORS AND HOLDING UNITS FOR CELLS AND TISSUES, PLANTS AND LOW VERTEBRATES. VOLUME 1: STUDY REPORT Final Report
U. Erich, K. Gruenewald, R. Henkel, U. Hoepstein, G. Lippner, D. Kersting, W. Martin, G. Neumann, F. Pittermann, F. Vogel et al May 1977 405 p Prepared jointly with STEEL 2 Vol.
(Contract ESA-2915/76-F-WMT(SC))
(ESA-CR(P)-943-Vol-1) Avail: NTIS HC A18/MF A01

A design is presented for a bioscience facility onboard Spacelab with four incubators and holding units for low vertebrates of the fish and amphibia class, cells and tissues, and plants. The incubators are intended to fit into the Spacelab single rack conforming to the Spacelab utilization program. A design concept is set up based on supporting systems analyses comprising the system configuration, subsystems, and complementary devices, as well as the experiment analysis, i.e., what the users can do with this incubator facility according to their scientific program. A model philosophy, plans for construction, tests and quality assurance, parts and materials lists, and operation procedures are dealt with and a full costing of the building phase is provided. A low cost approach is applied. Whenever possible, already existing hardware compatible with Spacelab constraints is taken into account. The updated equipment specifications are added. Author (ESA)

N77-29731# Dornier-System G.m.b.H., Friedrichshafen (West Germany).
STUDY ON INCUBATORS AND HOLDING UNITS FOR CELLS AND TISSUES, PLANTS AND LOW VERTEBRATES. VOLUME 2: DRAWINGS Final Report
U. Erich, K. Gruenewald, R. Henkel, U. Hoepstein, G. Lippner, D. Kersting, W. Martin, G. Neumann, F. Pittermann, F. Vogel et al May 1977 114 p 2 Vol.
(Contract ESA-2915/76-F-WMT(SC))
(ESA-CR(P)-943-Vol-2) Avail: NTIS HC A06/MF A01

Blueprints of four incubators and holding units for a bioscience facility onboard Spacelab are presented. The incubators are intended to contain low vertebrates of the fish and amphibia class, cells and tissues, and plants, and to fit into the Spacelab single rack conforming to the Spacelab utilization program. ESA

N77-29732# European Space Agency, Paris (France).
ELECTRON MICROSCOPE INVESTIGATIONS OF THE EFFECT OF FIVE-DAY WEIGHTLESSNESS SIMULATION ON THE DEVELOPMENT OF THE FROG EMBRYO (RANA TEMPORARIA) VESTIBULAR ORGAN
Juergen Neubert, Wolfgang Briegleb, Albrecht Schatz et al Jul. 1977 33 p refs Transl. into ENGLISH of 'Elektronenmikroskop. Untersuch. ueber den Einfluss fuenftaegiger Schwerelosigkeits-simulation auf die Entwicklung des Vestibularorgans von Frosch-embryonen der Gattung Rana temporaria', DFVLR, Bonn Report DLR-FB-76-66, 7 Dec. 1976 Original report in GERMAN previously announced as N77-25771 Original German report available from DFVLR, Cologne DM 17
(ESA-TT-397; DLR-FB-76-66) Avail: NTIS HC A03/MF A01

Results of experiments with fertilized frog eggs which developed under conditions of five days simulated weightlessness are described. The tests were designed to determine if there is any effect on the ability of the eggs to divide normally and on subsequent differentiation especially of the gravity receptor located in the vestibular organ. The submicroscopic structure of the macula utriculi (sensory epithelium) was compared between test and control animals. No abnormalities could be detected in the morphological structure. The results were compared with those of comparable experiments at zero g (Soyuz 10, Biosatellite 2, Gemini 8 and 12) and very good agreement was noted. Indications are given for future experimental steps to obtain greater clarity concerning the function of the gravity organ under conditions of simulated and real weightlessness. These experiments should be histo- and cytochemical ones. Author (ESA)

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N77-29733 University of the Pacific, Stockton, Calif.
THE TRAINING OF HUMAN VOLUNTARY TORSION: TONIC AND DYNAMIC CYCLOVERSION Ph.D. Thesis
Richard Balliet 1976 115 p
Avail: Univ. Microfilms Order No. 77-7809

Using a visual biofeedback technique, subjects were trained to make accurate voluntary tonic cycloversions up to 26.5 degrees in magnitude. Tonic cycloversions were defined as cycloversions which could be sustained for a 5 second duration. Towards the end of training subjects were able to make voluntary cycloversions in the absence of any visual stimulus. In all tests where rotating visual stimuli were used voluntary cycloversions were not found to be significantly visually induced. All voluntary cycloversions

were shown to be pure cycloversions around the visual axes.
Dissert. Abstr.

N77-29734 Michigan Univ., Ann Arbor.
THE EFFECT OF THE ACOUSTIC REFLEX ON THE PERCEPTION OF SPEECH IN NOISE Ph.D. Thesis
Bruce Zachary Rappaport 1976 108 p
Avail: Univ. Microfilms Order No. 77-8015

The acoustic reflex serves to improve the intelligibility of speech in the presence of a competing noise background by altering the masking efficiency of the noise. For normal hearing with normally functioning acoustic reflexes, the intelligibility of consonants within monosyllabic utterances was measured in a background of wide-band noise. Speech-in-noise was presented in one ear, while a wide-band noise simultaneously presented in the opposite ear activated the acoustic reflex, the action of which is bilateral. Results suggest that the acoustic reflex may act to extend the linear range of auditory transmission to the cochlea. Dissert. Abstr.

N77-29735 Stanford Univ., Calif.
A CASE STUDY EVALUATION OF A SATELLITE VIDEO TELEMEDICINE PROJECT IN RURAL ALASKA Ph.D. Thesis
Dennis Read Foote 1976 225 p
Avail: Univ. Microfilms Order No. 77-7087

The findings of an empirical evaluation of a project using satellite television to support health care delivery in the Alaskan bush are reported. Two clinics in remote villages and a field hospital in another village were outfitted with television and satellite equipment that enabled them to transmit and receive a black-and-white video signal. The evaluation of the project used a variety of data collection techniques and sources to investigate the technical performance and the level of usage of the telemedicine system, the effects of the teleconsults on the processes and outcomes of the medical care, and the attitudes of the participants. Dissert. Abstr.

N77-29736 Michigan Univ., Ann Arbor.
CIRCULATORY AND LOCAL MUSCLE RESPONSE TO STATIC MUTUAL WORK Ph.D. Thesis
Thomas Jeffrey Armstrong 1976 225 p
Avail: Univ. Microfilms Order No. 77-7857

Examined are selected physiological and biomechanical aspects of manual work to determine if there is a relationship between: (1) circulatory performance and the intensity and duration of work; (2) circulatory and local muscle performance; (3) circulatory and local muscle performance and strength and sex of the subjects; (4) circulatory and local muscle performance and the position of the hand. Empirical models of the performance data showed that for a given relative work intensity, higher levels of mean arterial pressure, heart rate, double product, and forearm blood flow and lower levels of forearm resistance to blood flow were attained in the male subjects than in the female subjects. However, the average strength of the male subjects was much greater than the average strength of the female subjects. Therefore, a relationship between performance and sex cannot be distinguished from a relationship between performance and strength. Dissert. Abstr.

N77-29737 Purdue Univ., Lafayette, Ind.
COMPUTER-AIDED DIFFERENTIAL DIAGNOSIS OF HYPERTENSION Ph.D. Thesis
Wilfred Aaron Fordon 1976 191 p
Avail: Univ. Microfilms Order No. 77-7449

The development of a simple, effective hard three-nearest-neighbor algorithm to screen potential primary Aldosteronism patients is reported. Another result was a multistage algorithm using a modified form of the three-nearest-neighbor technique in tandem with modern conventional diagnostic procedures to determine potential Renovascular hypertensive patients. Preliminary investigation of an algorithm to optimize the techniques has resulted in confirming potential improvements over the hard techniques. Dissert. Abstr.

N77-29738*+ National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 168
Jun. 1977 95 p
(NASA-SP-7011(168)) Avail: NTIS HC E02 CSCL 06E

This bibliography lists 229 reports, articles, and other documents introduced into the NASA scientific and technical information system in May 1977. Author

N77-29739*+ National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 169, JULY 1977
Jul. 1977 73 p
(NASA-SP-7011(169)) Avail: NTIS HC E02 CSCL 06E

This bibliography lists 230 reports, articles, and other documents introduced into the NASA scientific and technical information system in June 1977. Author

N77-29740# European Space Agency, Paris (France).
DEFINITION STUDY FOR SPACELAB EXPERIMENTS IN THE FIELD OF BASIC MEDICINE AND PROCESS ENGINEERING
Ull Erich, Wolfgang Hepp et al Jul. 1977 156 p refs Transl. into ENGLISH of 'Studie zur Definition von Spacelab-Experimenten aus dem Bereich der Med. Grundlagen u. Verfahrenstech.', Dornier System GmbH, Friedrichshafen Report BMFT-FB-W-76-15, Nov. 1976 Original report in GERMAN previously announced as N77-23747 Original GERMAN report available from ZLDI, Munich DM 38.45
(ESA-TT-391; BMFT-FB-W-76-15) Avail: NTIS HC A08/MF A01

Investigations on potential influences of Spacelab parameters on physiological and medical functions have revealed the possible use of Spacelab for medical tasks. A number of biomedical experiment proposals, defined during the course of the study in discussions with medical doctors, are presented. A first listing of instruments necessary to conduct the experiments in Spacelab is given and various activities to prepare Spacelab experiments are proposed. Author (ESA)

N77-29741# California Univ., San Francisco.
THE ROLE OF INORGANIC PHOSPHATE IN OXYGEN TRANSPORT Annual Progress Report, 1976 - 1977
George F. Sheldon Feb. 1977 17 p
(Contract DADA17-72-C-2030)
(AD-A038769) Avail: NTIS HC A02/MF A01 CSCL 07/2

The studies examine the mechanisms causing anemia associated with massive transfusion, injury, and protein depletion. Following injury protein depletion occurs, with loss of inorganic phosphate. As inorganic phosphate modulates red cell glycolysis, it is basic to oxygen transport. The study suggests that during anemia, oxygen unloading is increased as 2,3 DPG levels increase. By assessing erythropoieting in conjunction with red cell oxygen unloading capabilities, we have presumptive evidence that the hypoxic stimulus which results in erythropoietin elevation which causes red cell production, is compensated for by 2-3 DPG elevation. The persistent reticulopenic anemia which follows injury and results in the need for blood transfusion, may be due to DPG compensation for hypoxia failure of erythropoietin production and persistent anemia. Author (GRA)

N77-29742# Utah Univ., Salt Lake City. Dept. of Computer Science.
DIGITAL COLOR IMAGE PROCESSING AND PSYCHOPHYSICS WITHIN THE FRAMEWORK OF A HUMAN VISUAL MODEL
Olivier Dominique Faugeras Jun. 1976 134 p refs
(Contract DAHC15-73-C-0363; ARPA Order 2477)
(AD-A039007; UTEC-CSC-77-029) Avail: NTIS HC A03/MF A01 CSCL 06/16

A three-dimensional homomorphic model of human color vision based on neurophysiological and psychophysical evidence is presented. This model permits the quantitative definition of perceptually important parameters such as brightness, saturation, hue and strength. By modelling neural interaction in the human visual system as three linear filters operating on perceptual quantities, this model accounts for the automatic gain control properties of the eye and for brightness and color contrast effects.

A psychophysical experiment was performed, using a high quality color television monitor driven by a general purpose digital computer. This experiment, based on the cancellation by human subjects of simultaneous color contrast illusions, allowed measurement of the low spatial frequency part of the frequency responses of the filters operating on the two chromatic channels of the human visual system. GRA

N77-29743# National Inst. for Occupational Safety and Health, Cincinnati, Ohio. Div. of Biomedical and Behavioral Science.
TECHNOLOGY FOR THE DEVELOPMENT OF A PORTABLE METABOLIC MONITOR
Ralph H. James Jun. 1976 50 p refs
(PB-266215/3; DHEW/PUB/NIOSH-76-171; NIOSH-76/171) Avail: NTIS HC A03/MF A01 CSCL 06B

The need for an instrument to measure oxygen consumption to determine energy expenditure by indirect calorimetry at the job site under all work conditions is presented, with the characteristics of such an instrument. Evaluation of available devices in relation to stated requirements for breath-to-breath analysis and interval averaging is used to indicate the necessary components of the monitor. A portable metabolic monitor is described which is of recent European manufacture and design and which appears to meet all the major design requirements, with the exception of a flow meter. GRA

N77-29744# Occupational Safety and Health Administration, Washington, D. C.
INORGANIC ARSENIC Final Report
4 Feb. 1977 135 p refs
(PB-266182/5; OSHA-EIS-77-0204) Avail: NTIS HC A07/MF A01 CSCL 06J

Employee exposure to inorganic arsenic and its compounds is regulated by requiring that no employee be exposed to these substances above specific permissible exposure limits. A beneficial impact should be a reduction in the amount of excess morbidity and mortality experienced by persons occupationally exposed to inorganic arsenic. Major alternatives considered include regulation of ionorganic arsenic on the basis of its valence state or on the basis of specific chemical characteristics, regulation to various permissible exposure limits, use of biological monitoring versus environmental monitoring, and the use of personal protective equipment versus other means of exposure control. GRA

N77-29745# Occupational Safety and Health Administration, Washington, D. C.
SULFUR DIOXIDE
Apr. 1977 92 p refs
(PB-266160/1; OSHA-EIS-77-0415-D) Avail: NTIS HC A05/MF A01 CSCL 06J

Employee exposure to sulfur dioxide emissions are regulated by setting a permissible exposure limit of 2 parts sulfur dioxide per million parts air. Employee exposure measurements, methods of compliance, personal protective clothing and equipment, training, medical surveillance, employee observation of exposure measurements, and recordkeeping are discussed. This standard would apply to all workplaces in which employees are engaged in the production, release, storage, handling transportation, or use of sulfur dioxide. Beneficial impact on the workplace environment will be a reduction in the health effects associated with hazardous exposure to sulfur dioxide. GRA

N77-29746# Illinois Univ., Chicago. School of Public Health.
HEALTH EFFECTS OF OCCUPATIONAL LEAD AND ARSENIC EXPOSURE
Bertram W. Carnow Feb. 1976 354 p refs Symp. held at Chicago, 24-25 Feb. 1975
(Contract PHS-210-75-0026)
(PB-266213/8; DHEW/PUB/NIOSH-76-134; NIOSH-76-134) Avail: NTIS HC A16/MF A01 CSCL 06J

Papers were presented at a symposium to consider the impact of lead and arsenic on the workers' health, and to assist in establishing safe levels of these metals. Topics included: sources of lead and arsenic and monitoring of workplace both environmentally and biologically; toxicology of lead and arsenic; epidemiology of arsenic and lead exposure, long-term effects, and community exposure studies; carcinogenic effects of arsenic; and problems in setting threshold limit values for arsenic. GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N77-29747# European Space Agency, Paris (France).
ON THE PRACTICAL UTILITY OF CRITICAL FLICKER FUSION FREQUENCY MEASUREMENTS TO THE ASSESSMENT OF MENTAL WORKLOAD
Fred Volker Schick Jul. 1977 63 p refs Transl. into ENGLISH of 'Ueber die Verwendbarkeit einer praxisorientierten Messtech. der Flimmerverschmèlzungsfrequenz zur Erfassung geistiger Belastung', DFVLR, Brunswick Report DLR-FB-76-67, 14 Dec. 1976 Original report in GERMAN previously announced as N77-25781 Original German report available from DFVLR, Cologne DM 19.10
(ESA-TT-398; DLR-FB-76-67) Avail: NTIS HC A04/MF A01

Two experiments were conducted to evaluate the utility of an advanced measuring device, coupled with a practicable measurement procedure, with respect to reliable and valid assessment of mental workload by measuring critical flicker fusion frequency (CFF). In the first experiment, basic variability of CFF scores, obtained from 11 subjects under nonworkload conditions, was studied. Error of measurement as well as physical and psychical interference variables were discussed to be sources of the large oscillations actually observed from data. It was found necessary to modify the measurement procedure. In the second experiment 10 subjects' CFF thresholds were examined. Statistical analysis revealed generally low reliability coefficients. Also thresholds failed to discriminate between low workload and high workload treatments. Results suggest that the magnitude of threshold's fluctuations due to individual physical and psychical interferences exceed threshold's alterations due to treatments.
Author (ESA)

N77-29748# Illinois Univ., Urbana-Champaign. Aviation Research Lab.
TASK COMPONENTS AND DEMANDS AS FACTORS IN DUAL-TASK PERFORMANCE
Robert Arthur North Jan. 1977 118 p refs
(Contract F44620-76-C-0009; AF Proj. 2313)
(AD-A038634; ARL-77-2/AFOSR-77-2) Avail: NTIS HC A06/MF A01 CSCL 05/5

This study explored the effects of interference between tasks as related to their specific functional requirements and under changing priorities. Four tasks were performed singly and in all pairwise combinations to compare their mutual interference levels. The tasks were one-dimensional compensatory tracking, and three self-paced Keyboard response tasks, one requiring a transformation by categorizing, one requiring storing and responding with the previous stimulus, and one requiring no intervening activity between stimulus recognition and response. Tracking paired with any of the the three Keyboard tasks was least interfering, Tracking and Tracking was moderately interfering, and Keyboard/Keyboard combinations the most interfering, suggesting that qualitatively dissimilar tasks are performed better than functionally similar tasks. The Keyboard task requiring continuous storing and response to the previous stimulus was highly disruptive when paired with other Keyboard tasks, and showed little evidence of interweaving with them, while the transformation Keyboard task was not as disruptive and could be interweaved with itself or the simple Keyboard task. GRA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N77-29749 Michigan Univ., Ann Arbor.
A METABOLIC RATE PREDICTION MODEL FOR MANUAL MATERIALS HANDLING JOBS Ph.D. Thesis
Arun Garg 1976 274 p
Avail: Univ. Microfilms Order No. 77-7920

A model was developed to estimate metabolic energy expenditure rates for a wide variety of manual materials handling jobs. The model is based on the assumption that a job can be divided into simple tasks (activity elements) and that the average metabolic energy expenditure rate of the job can be predicted by knowing the energy expenditures of the simple tasks and the time duration of the job. Dissert. Abstr.

N77-29750*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE 2ND CONFERENCE ON REMOTELY MANNED SYSTEMS (RMS): TECHNOLOGY AND APPLICATIONS
Jun. 1975 105 p Conf. held at Pasadena, Calif., 9-11 Jun. 1975 Sponsored in part by NASA, Southern Calif. Univ., Human Factors Soc., and US Council for the Theory of Machines and Mechanisms
(NASA-CR-148013) Avail: NTIS HC A06/MF A01 CSCL 05H

Control theory and the design of manipulators, teleoperators, and robots are considered. Applications of remotely manned vehicles to space maintenance and orbital assembly, industry and productivity, undersea operations, and rehabilitation systems are emphasized. For individual titles, see N77-29751 through N77-29787.

N77-29751*# Massachusetts Inst. of Tech., Cambridge.
CURRENT THEORIES OF MAN-MACHINE SYSTEMS
Thomas B. Sheridan *In* JPL The 2nd Conf. on Remotely Manned Systems RMS Jun. 1975 p 1-2 refs (For primary document see N77-29750 20-54)
Avail: NTIS HC A06/MF A01 CSCL 05H

Theories and models conventionally employed to analyze man machine systems such as remotely manned vehicles and processes are reviewed. Basic ideas of supervisory or heirarchical manning, and needs for modeling are discussed. Author

N77-29752*# University of Southern Calif., Los Angeles. Dept. of Industrial and Systems Engineering.
STOCHASTIC MODELLING OF REMOTELY MANNED SYSTEMS
Clinton J. Ancker, Jr. *In* JPL The 2nd Conf. on Remotely Manned Systems (RMS) Jun. 1975 p 3-4 refs (For primary document see N77-29750 20-54)
Avail: NTIS HC A06/MF A01 CSCL 05H

Digital simulation models of remotely manned vehicles are discussed and recommendations for statistical validation of all the models are considered. Author

N77-29753*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE HUMAN CONTROLLER IN CAR FOLLOWING
G. O. Burnham (Univ. of Southern Calif., Los Angeles) and G. A. Bekey *In its* The 2nd Conf. on Remotely Manned Systems (RMS) Jun. 1975 p 5-6 refs (For primary document see N77-29750 20-54)
Avail: NTIS HC A06/MF A01 CSCL 05H

The man machine interface between the human driver and his automobile during car following tasks was examined. A direct connection between models of the human operator and the theory of optimal control was established for car following situations involving both linear and nonlinear car dynamics. Results obtained from several types of mathematical models are discussed. Conventional parameter identification techniques were used to obtain the parameters of these models by comparing their performance to data obtained by aerial photogrammetry. The results indicate that there are two general classes of model structures: models assumed to have preview information and models without preview. Author

N77-29754*# Sandia Labs., Albuquerque, N. Mex.
AN INVESTIGATION OF SUPERVISORY CONTROL OF REMOTE MANIPULATION
Douglas E. McGovern *In* JPL The 2nd Conf. on Remotely Manned Systems (RMS) Jun. 1975 p 7-8 refs Sponsored in part by ERDA (For primary document see N77-29750 20-54)
Avail: NTIS HC A06/MF A01 CSCL 05H

Various types of augmented control for remote manipulation are discussed. A simple supervisory control program, is described and an estimate of system performance is given. Author

N77-29755*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EFFECT OF HAND-BASED SENSORS ON MANIPULATOR CONTROL PERFORMANCE
Antal K. Bejczy *In its* The 2nd Conf. on Remotely Manned Systems (RMS) Jun. 1975 p 9-10 refs (For primary document see N77-29750 20-54)
(Contract NAS7-100)
Avail: NTIS HC A06/MF A01 CSCL 05H

The effect of hand based sensors (e.g tactile, force, and proximity sensors) on the performance of manipulator control is discussed. A brief overview is presented on various experimental hand based information systems which provide the manipulator controller some nonvisual awareness of the task environment. It is established that differences in manipulator task categories and motion phases require different hand based information systems to cope with control performance requirements. Author

N77-29756*# Stanford Research Inst., Menlo Park, Calif.
LOCATION AND ACQUISITION OF OBJECTS IN UNPREDICTABLE LOCATIONS
A. J. Sword and W. T. Park *In* JPL The 2nd Conf. on Remotely Manned Systems (RMS) Jun. 1975 p 11-13 refs (For primary document see N77-29750 20-54)
(Contract DAAA15-74-C-0095)
Avail: NTIS HC A01/MF A01 CSCL 05H

A teleoperator system with a computer for manipulator control to combine the capabilities of both man and computer to accomplish a task is described. This system allows objects in unpredictable locations to be successfully located and acquired. By using a method of characterizing the work-space together with man's ability to plan a strategy and coarsely locate an object, the computer is provided with enough information to complete the tedious part of the task. In addition, the use of voice control is shown to be a useful component of the man/machine interface. Author

N77-29757*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
TV REQUIREMENTS FOR MANIPULATION IN SPACE
Larry A. Freedman (RCA, Princeton, N.J.), William H. Crooks (Perceptronics, Inc., Woodland Hills, Calif.), and Paul P. Coan *In* JPL The 2nd Conf. on Remotely Manned Systems (RMS) Jun. 1975 p 15 (For primary document see N77-29750 20-54)
Avail: NTIS HC A06/Mf A01 CSCL 05H

A video system for remote manipulation in space was studied. Analysis of basic manipulation tasks and visual requirements; simulation testing to determine the effects of task, scene parameter, and type of video system on manipulation performance; and video system selection and specification are described. Author

N77-29758*# Tennessee Univ., Knoxville. Dept. of Electrical Engineering.
GRAY-LEVEL TRANSFORMATIONS FOR INTERACTIVE IMAGE ENHANCEMENT.
R. C. Gonzalez and B. A. Fittes *In* JPL The 2nd Conf. on Remotely Manned Systems (RMS) Jun. 1975 p 17-19 refs (For primary document see N77-29750 20-54)
(Contract NAS8-29271)
Avail: NTIS HC A06/MF A01 CSCL 05H

A gray-level transformation method suitable for interactive image enhancement is presented. It is shown that the well-known histogram equalization technique is a special case of this method. Experimental results which establish the superiority of the procedure over histogram equalization are also described. Author

N77-29759*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
INTERACTIVE HANDLING OF TV AND RANGE DATA FOR REMOTELY CONTROLLED SYSTEMS
Yoram Yakimovsky *In its* The 2nd Conf. on Remotely Manned Systems (RMS) Jun. 1975 p 21 (For primary document see N77-29750 20-54)

(Contract NAS7-100)
Avail: NTIS HC A06/MF A01 CSCL 05H

The sensory subsystem of the JPL robotics project is described. The first sensory instrument is a pair of TV cameras, which provides a stereo view of the area of interest. The second is a laser range finder, which can be aimed in a requested direction and measure distance to a surface point that reflects the beam back. Both instruments are controlled by and are interfaced to computer. The calibration process and basic applications to obtain measurements of the external environment are described. Author

N77-29760*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PROXIMITY SENSOR TECHNOLOGY FOR MANIPULATOR END EFFECTORS
Alan R. Johnston *In its* The 2nd Conf. on Remotely Manned Systems (RMS) Jun. 1975 p 23-24 (For primary document see N77-29750 20-54)
(Contract NAS7-100)
Avail: NTIS HC A06/MF A01 CSCL 05H

Optical proximity sensing techniques which could be used to help control the critical grasping phase of a remote manipulation are described. The proximity sensors described use a triangulation geometry to detect a surface located in a pre-determined region. The design of the proximity sensors themselves is discussed, as well as their application to manipulator control with a local control loop, and possibilities for future development are discussed. Author

N77-29761*# Massachusetts Univ., Amherst.
DESIGN FOR A THREE-FINGERED HAND
F. R. Erskine Crossley and Franklyn G. Umholtz *In* JPL The 2nd Conf. on Remotely Manned Systems (RMS) Jun. 1975 p 25 (For primary document see N77-29750 20-54)
Avail: NTIS HC A06/MF A01 CSCL 05H

A general purpose end-effector for use on the space manipulator proposed for the shuttle program was developed. The end-effector has the capabilities of a human hand and peel-off value as a human prosthetic device. The design evolved through two mock-up stages. The final form contains four electric motors. While thumb and forefinger bend, their ultimate phalanges maintain a parallel stance to one another. The grip centerline is at 45 degrees to the mounting base. Author

N77-29762*# Nebraska Univ., Lincoln.
THE LEMMA CONCEPT: A NEW MANIPULATOR
Leendert Kersten *In* JPL The 2nd Conf. on Remotely Manned Systems (RMS) Jun. 1975 p 27-28 refs (For primary document see N77-29750 20-54)
Avail: NTIS HC A06/MF A01 CSCL 05H

The differential drive assembly of Laboratory Engineering Model Manipulator Arm is briefly described. A theoretical investigation of the arm showed that the required accuracy of the manipulator is attainable. J.M.S.

N77-29763*# Essex Corp., Huntsville, Ala.
MANIPULATOR SYSTEM PERFORMANCE MEASUREMENT
M. Kirkpatrick, N. L. Shields, Jr., and T. B. Malone *In* JPL The 2nd Conf. on Remotely Manned Systems (RMS) Jun. 1975 p 29-30 refs (For primary document see N77-29750 20-54)
(Contract NAS8-30545)
Avail: NTIS HC A06/MF A01 CSCL 05H

Free-flying teleoperator technology for satellite servicing is reported. The rationale for a series of manipulator system tests is presented. Data are reported on movement time in a fine positioning task using two different manipulator systems. The movement time data showed reliable effects of movement direction and index of difficulty. These data were considered to be baseline performance measures for the manipulator system used and modifications to the control and visual systems were suggested for future testing. Author

N77-29764*# V. I. Lenin Higher Institute of Electrical and Mechanical Engineering, Sofia (Bulgaria).
INERTIA FORCES IN ROBOTS AND MANIPULATORS
Michael S. Konstantinov *In* JPL The 2nd Conf. on Remotely Manned Systems (RMS) Jun. 1975 p 31-32 refs (For primary document see N77-29750 20-54)
Avail: NTIS HC A06/MF A01 CSCL 05H

A method is described for the simulation of the dynamic behavior (inertia forces) of a solid performing a tridimensional motion, wherein a discrete system of mass points rigidly attached to the solid is used. Three postulates are necessary and sufficient for dynamical equivalence: (1) the mass of the solid and the total of the concentrated masses should be equal, (2) the center of gravity of the solid and of the discrete system should coincide, and (3) the inertial ellipsoid of the solid and of the discrete system should be equal. Author

N77-29765*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REMOTE SERVICING OF FREE-FLYING SPACECRAFT
F. J. Cepollina and J. M. Mansfield (Rockwell Intern., Downey, Calif.) *In* JPL The 2nd Conf. on Remotely Manned Systems (RMS) Jun. 1975 p 33-34 (For primary document see N77-29750 20-54)
Avail: NTIS HC A06/MF A01 CSCL 05H

A ground simulation to demonstrate system compatibility by enacting satellite ground installation, orbit delivery, space servicing, and contingency retrieval with the space shuttle orbiter was conducted. The basic configuration approach adopted for the spacecraft groups the standardized subsystems in the aft portion of the spacecraft and leaves the volume forward of the transition structure available for the mission peculiar equipment and sensors. The version used for this simulation is configured as an earth observatory with multispectral mapping and high resolution imaging sensors. All modules including the propulsion package and the sensor modules are replaceable on orbit in the event of depletion, wearout, malfunction, or the availability of an improved version. Author

N77-29766*# TRW Systems Group, Redondo Beach, Calif.
ON-ORBIT SERVICEABLE SATELLITE DESIGN
Abraham Fiul *In* JPL The 2nd Conf. on Remotely Manned Systems (RMS) Jun. 1975 p 35-36 (For primary document see N77-29750 20-54)
Avail: NTIS HC A06/MF A01 CSCL 05H

Replacement of failed or worn-out equipment while the satellite remains on-orbit is considered. Factors discussed include: modular construction of the satellite components, design of the service unit, and control of the service unit. J.M.S.

N77-29767*# Martin Marietta Corp., Denver, Colo.
ORBITAL SERVICING, AND REMOTELY MANNED SYSTEMS
George W. Smith and Wilfred L. DeRocher, Jr. *In* JPL The 2nd Conf. on Remotely Manned Systems (RMS) Jun. 1975 p 37-38 refs (For primary document see N77-29750 20-54)
(Contract NAS8-30820)
Avail: NTIS HC A06/MF A01 CSCL 05H

The potential of concepts and techniques of remotely manned aerospace systems to fully exploit the utility and benefits of orbital servicing is discussed. Orbital servicing in the form of module exchange enhances the STS goals through replacement of failed equipment, resupply of consumables, and updating of obsolete equipment. Author

N77-29768*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
SPACE TUG SPACECRAFT/MODULE EXCHANGER (ON-ORBIT SERVICER)
Fritz C. Runge *In* JPL The 2nd Conf. on Remotely Manned Systems (RMS) Jun. 1975 p 39 (For primary document see N77-29750 20-54)
(Contract NAS8-29743)
Avail: NTIS HC A06/MF A01 CSCL 05H

On-orbit exchange of spacecraft modules containing experiment or subsystem hardware or consumables performed at goesynchronous altitudes with the space tug and at lower altitudes with the shuttle is described. One promising concept for such a tug-mounted spacecraft module exchange is the McDonnell Douglas Direct-Access Servicer. This servicer can also be used in low orbit, mounted on the shuttle. In this concept, push-pull injector/retractor devices are combined with a rotating indexer to provide a minimum-complexity mechanism with a high capacity for coincident exchange of many modules. Author

N77-29769*# Comsat Labs., Clarksburg, Md.
A USER ASSESSMENT OF SERVICING AT GEOSTATIONARY ORBIT
Gary D. Gordon *In* JPL The 2nd Conf. on Remotely Manned Systems (RMS) Jun. 1975 p 41-42 (For primary document see N77-29750 20-54)
(Contract NAS8-30849)
Avail: NTIS HC A06/MF A01 CSCL 05H

Orbital servicing assessed from the viewpoint of a commercial user of communications satellites at geostationary orbit. The need for servicing is emphasized by looking at the history of failures and defects occurring in communications satellites. The methods used in servicing were evaluated in terms of the needs of a communications satellite user. A system that utilizes servicing was studied, and some benefits in addition to cost savings were identified. Most of the assumptions and conclusions apply to earth observation satellites at geostationary orbit. Author

N77-29770*# Martin Marietta Corp., Denver, Colo.
THE ASSEMBLY OF LARGE STRUCTURES IN SPACE
George W. Smith and Shepard B. Brodie *In* JPL The 2nd Conf. on Remotely Manned Systems (RMS) Jun. 1975 p 43-44 (For primary document see N77-29750 20-54)
Contracts NAS9-14319; NAS3-17835
Avail: NTIS HC A06/MF A01 CSCL 05H

Techniques developed for orbital assembly of the support structure for a 1000 meter diameter microwave power transmission system antenna are described. The operation is performed in two phases using the shuttle remote manipulator system in low earth orbit, and a mobile assembler in geosynchronous orbit. Author

N77-29771*# Pennsylvania State Univ., University Park.
CONTROL AND STABILITY PROBLEMS OF REMOTE ORBITAL CAPTURE
M. H. Kaplan and A. A. Nadkarni *In* JPL The 2nd Conf. on Remotely Manned Systems (RMS) Jun. 1975 p 45-46 refs (For primary document see N77-29750 20-54)
(Grants NGR-39-009-162; NsG-7078)
Avail: NTIS HC A06/MF A01 CSCL 05H

The dynamics and control aspects of orbital capture of space objects were studied. Differential angular rates and orientation between the object and the grappler were used to investigate the effects of misalignment as well as stability and control. The control responses after capture are discussed. The feasibility of nulling combined spin and nutation of a typical satellite is demonstrated by a Lagrangian formulation to establish a baseline situation. A free-flying teleoperator (FFTO) with a dynamically unbalanced grappler is shown to be desirable because extremely adverse cyclic torques may be generated. A combined teleoperator-satellite system assuming misalignments during capture was dynamically analyzed. Related responses and stability evaluations are included. Author

N77-29772*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
REMOTELY PILOTED AIRCRAFT IN THE CIVIL ENVIRONMENT
Thomas J. Gregory, Walter P. Nelms, and Jay Karmarkar (Systems Control, Inc., Palo Alto, Calif.) *In* JPL The 2nd Conf. on Remotely Manned Systems (RMS) Jun. 1975 p 47-48 (For primary document see N77-29750 20-54)
Avail: NTIS HC A06/MF A01 CSCL 05H

Existing remotely piloted vehicle application programs are described along with the technology of several important subsystems and the potential vehicle uses and operational concepts. Regulatory constraints and present and future study activities that may lead to demonstration and then operational programs are discussed. Author

N77-29773*# Office of the Oceanographer of the Navy, Alexandria, Va.
AN OVERVIEW OF UNDERWATER REMOTELY MANNED SYSTEMS AND SUB-SYSTEMS
Andreas Rechnitzer, B. *In* JPL The 2nd Conf. on Remotely Manned Systems (RMS) Jun. 1975 p 49 (For primary document see N77-29750 20-54)
Avail: NTIS HC A06/MF A01 CSCL 05H

A current overview of how the underwater facet of remotely manned systems has progressed since 1972 is presented. The current approaches being pursued and the success of American and foreign technology is assessed. Author

N77-29774*# Naval Undersea Center, San Diego, Calif.
AN UNDERWATER WORK SYSTEMS PACKAGE
Norman B. Estabrook *In* JPL The 2nd Conf. on Remotely Manned Systems (RMS) Jun. 1975 p 51-52 (For primary document see N77-29750 20-54)
Avail: NTIS HC A06/MF A01 CSCL 05H

A modular unit which is adaptable to several existing deep sea submersibles was developed to extend their working abilities and acquire knowledge of components and techniques for working in the deep sea environment. This work systems package is composed of an aluminum pipe structure on which are mounted two six-function grabber arms, a seven function manipulator, tool suit, 1,000/lb. capacity winch, electrohydraulic power supply, electronics housing, lights, and television. The unit is designed to be operated by itself either remotely or with divers, attached to manned submersibles, or mounted on unmanned cable-controlled submersibles. Author

N77-29775*# Woods Hole Oceanographic Institution, Mass.
FORCE FEEDBACK SYSTEMS IN UNDERSEA MANIPULATOR APPLICATIONS
Alan J. Pesch (Eclectech Assoc., Inc.), William R. Bertsche (Eclectech Assoc., Inc.), and Clifford Winget *In* JPL The 2nd Conf. on Remotely Manned Systems (RMS) Jun. 1975 p 57-58 refs (For primary document see N77-29750 20-54)
Avail: NTIS HC A06/MF A01 CSCL 05H

The manual control behavior of the operator with various levels of manipulator system complexity was studied in order to determine the relationships among control system dynamics, certain base engineering variables, controller designs and system performance. Based on the data obtained, a set of general transfer functions were prepared to provide a mathematical model of the various levels of potential force feedback fidelity as a function of force backlash present in alternate engineering designs. Author

N77-29776*# Perceptronics, Inc., Woodland Hills, Calif.
CONTROL AUTOMATION IN UNDERSEA MANIPULATION SYSTEMS
Amos Freedy and Gershon Weltman *In* JPL The 2nd Conf. on Remotely Manned Systems (RMS) Jun. 1975 p 59-60 refs (For primary document see N77-29750 20-54)
Avail: NTIS HC A06/MF A01 CSCL 05H

The requirements for the successful use of automated manipulation in an undersea environment are discussed, and initial specifications for systems which share control between a human operator and an autonomous control element are established. Areas of concern include: (1) objectives of automation; (2) characteristics of the underwater task; (3) hierarchy of control algorithms; (4) man/machine interface; (5) sensory feedback; and (6) general system organization. Special emphasis is placed on the solutions to the problem of controlling an undersea manipulator which is capable of performing certain automatic functions and implementing these solutions using current technology. Current capabilities for control automation are summarized. Author

N77-29777*# Stuttgart Univ. (West Germany).
INDUSTRIAL ROBOTS IN EUROPE - MARKET, APPLICATIONS AND DEVELOPMENTS
Rolf D. Schraft *In* JPL The 2nd Conf. on Remotely Manned Systems (RMS) Jun. 1975 p 63-64 refs (For primary document see N77-29750 20-54)
Avail: NTIS HC A06/MF A01 CSCL 05H

Different companies involving a wide range of products and manufacturing processes were studied to define the requirements for industrial robots. A survey of all such automatic units offered on the world market was made to establish a data base. Principal applications include coating, spot welding, and loading and unloading operations. Author

N77-29778*# Unimation, Inc., Danbury, Conn.
DESIGNING ROBOTS FOR INDUSTRIAL ENVIRONMENTS
In JPL The 2nd Conf. on Remotely Manned Systems (RMS) Jun. 1975 p 65 (For primary document see N77-29750 20-54)
Avail: NTIS HC A06/MF A01 CSCL 05H

Environmental hazards to industrial robots are summarized. The inherent reliability of the design of the Unimate robot is assessed and the data used in a management system to bring the reliability performance up to a level nearing what is theoretically available. The design is shown to be capable of a mean time between failure of 400 hours and an average up time of 98%. Specific design decisions made in view of application requirements are explored. Author

N77-29779*# Stanford Research Inst., Menlo Park, Calif.
TOPICS IN PROGRAMMABLE AUTOMATION
C. A. Rosen *In* JPL The 2nd Conf. on Remotely Manned Systems (RMS) Jun. 1975 p 67-68 refs (For primary document see N77-29750 20-54)
Avail: NTIS HC A06/MF A01 CSCL 05H

Topics explored in the development of integrated programmable automation systems include: numerically controlled and computer controlled machining; machine intelligence and the emulation of human-like capabilities; large scale semiconductor integration technology applications; and sensor technology for asynchronous local computation without burdening the executive minicomputer which controls the whole system. The role and development of training aids, and the potential application of these aids to augmented teleoperator systems are discussed.

N77-29780*# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
INFORMATION AND CONTROL ISSUES OF ADAPTABLE-PROGRAMMABLE ASSEMBLY SYSTEMS FOR MANUFACTURING AND TELEOPERATOR APPLICATIONS
J. L. Nevins and D. E. Whitney *In* JPL The 2nd Conf. on Remotely Manned Systems (RMS) Jun. 1975 p 69-70 (For primary document see N77-29750 20-54)
Avail: NTIS HC A06/MF A01 CSCL 05H

The real requirements of a task or task environment must be considered in developing a program for mechanical or electrical manipulators. Manipulation tasks must be analyzed, the information and control needed to accomplish them must be determined, and sensors, movers, controllers, and displays must be designed. Operations research in developing a computer controlled man-supervised multi-moded manipulator for an assembly system is described. Author

N77-29781*# Waseda Univ., Tokyo (Japan).
ARTIFICIAL SOFTNESS SENSING - AN AUTOMATIC APPARATUS FOR MEASURING VISCOELASTICITY
I. Kato, Y. Kudo, and K. Ichimaru *In* JPL The 2nd Conf. on Remotely Manned Systems (RMS) Jun. 1975 p 79-80 refs (For primary document see N77-29750 20-54)
Avail: NTIS HC A06/MF A01 CSCL 05H

Synthetic polymer models of several degrees of softness were subjected to standard creep tests to determine their viscoelastic characteristics. The automatic measuring apparatus and the theory of measurement used in modeling the human recognition of the softness factor are described. Author

N77-29782*# California Univ., Los Angeles. Biotechnology Lab.
SYSTEM INTEGRATION OF PATTERN RECOGNITION, ADAPTIVE AIDED, UPPER LIMB PROSTHESES
John Lyman, Amos Freedy, and Moshe Solomonow *In* JPL The 2nd Conf. on Remotely Manned Systems (RMS) Jun. 1975 p 81 refs (For primary document see N77-29750 20-54)
Avail: NTIS HC A06/MF A01 CSCL 05H

The requirements for successful integration of a computer aided control system for multi degree of freedom artificial arms are discussed. Specifications are established for a system which shares control between a human amputee and an automatic control subsystem. The approach integrates the following subsystems: (1) myoelectric pattern recognition, (2) adaptive computer aiding; (3) local reflex control; (4) prosthetic sensory feedback; and (5) externally energized arm with the functions of prehension, wrist rotation, elbow extension and flexion and humeral rotation. Author

N77-29783*# Utah Univ., Salt Lake City.
APPLICATION OF A POSTULATE BASED CONTROL THEORY FOR AN ARTIFICIAL ARM
S. C. Jacobsen and R. B. Jerard *In* JPL The 2nd Conf. on Remotely Manned Systems (RMS) Jun. 1975 p 83-84 refs (For primary document see N77-29750 20-54)
Avail: NTIS HC A06/MF A01 CSCL 05H

The biocontroller, remnant of the natural arm, and feedback elements must be considered in designing a controller for an above elbow artificial arm for amputees. This fundamental postulate is used to derive equations for developing the controller, which is shown in block diagrams.

N77-29784*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VOICE CONTROLLED ADAPTIVE MANIPULATOR AND MOBILITY SYSTEMS FOR THE SEVERELY HANDICAPPED
E. Heer, G. A. Wiker, and A. Karchak, Jr. (Rancho Los Amigos Hospital, Downey, Calif.) *In its* 2nd Conf. on Remotely Manned Systems (RMS) Jun. 1975 p 85-86 (For primary document see N77-29750 20-54)
Avail: NTIS HC A06/MF A01 CSCL 05H

Efforts by NASA and the VA to apply available teleoperator/robot technology to rehabilitate amputees and spinal cord injured patients having severe loss of motor, manipulative, and sensory capabilities in the lower and/or upper extremities are summarized. Techniques developed include the control of a wheelchair by voice control or tongue chinswitch. The voice recognition computer and its operation are also described.

N77-29785*# Heidelberg Univ. (West Germany).
DESIGN AND CONTROL OF A MANIPULATOR FOR TETRAPLEGICS
V. Paeslack and H. Roesler *In* JPL The 2nd Conf. on Remotely Manned Systems (RMS) Jun. 1975 p 87-88 (For primary document see N77-29750 20-54)
Avail: NTIS HC A06/MF A01 CSCL 04H

A concept for the design of a manipulator for tetraplegics must be based on the mutual adaptation of system determining properties of the disabled operator, the manipulator, and the environment. Because the reduced capability of tetraplegics allows control of only three degrees of freedom at a time (instead of the normal fifteen), the structure of the environment must be adjusted. A manipulator is described which includes a three dimensional control stick operated by the lips and mouth. Author

N77-29786*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LUNAR ROVER VEHICLE - AN IMPLICATION FOR REHABILITATION
Samuel R. McFarland (Southwest Research Inst., San Antonio, Tex.) and Gary R. Primeauk *In* JPL The 2nd Conf. on Remotely Manned Systems (RMS) Jun. 1975 p 91 (For primary document see N77-29750 20-54)
Avail: NTIS HC A06/MF A01 CSCL 05H

The feasibility of adapting the lunar roving vehicle control concept to automobiles and vans for quadraplegics was investigated. Topics discussed include the current state of automobile handicapped controls, a description of the affected population, and a design for interfacing the control system into a passenger vehice.

N77-29787*# Institute M. Pupin, Belgrade (Yugoslavia).
NEW CONTROL CONCEPT OF ANTHROPOMORPHIC MANIPULATORS
M. Vukobratovic, D. Stokic, and D. Hristic *In* JPL The 2nd Conf. on Remotely Manned Systems (RMS) Jun. 1975 p 93-94 refs (For primary document see N77-29750 20-54)
Avail: NTIS HC A06/MF A01 CSCL 05H

The control of active articulated mechanisms involves the construction of trajectories and corresponding forces (torques). Two procedures for developing mathematical models of manipulator dynamics are explored. The control task can be formulated as follows: define the dynamic control parameters of the basic manipulator configuration with three degrees of freedom, which should perform movements at N points of the working space.

The task can be solved by forming programmed coordinated motion which have to realize the adopted tip trajectory. Author

N77-29788*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A PRELIMINARY INVESTIGATION OF THE ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM (EC/LSS) FOR THE SPACE CONSTRUCTION BASE MANUFACTURING MODULES
Hubert B. Wells Apr. 1977 56 p refs
(NASA-TM-78123) Avail: NTIS HC A04/MF A01 CSCL 06K

The preliminary data of the environmental control and life support subsystem for a space construction base manufacturing module was reported. A space processing module, which is capable of performing production biological experiments, was chosen as a baseline configuration. The primary assemblies and components considered for use were humidity and temperature control, ventilation fan, cabin fan, water separator, condensate storage, overboard dumping, distribution system, contaminant monitoring, cabin sensors, and fire and smoke detection. Author

N77-29789# Applied Psychological Services, Wayne, Pa.
DEVELOPMENT AND VALIDATION OF AN EQUATION FOR PREDICTING THE COMPREHENSIBILITY OF TEXTURAL MATERIAL Final Report, Mar. 1974 - Dec. 1976
Allan R. Williams, Arthur I. Siegel, James R. Burkett (AFHRL, Lowry AFB, Colo.), and Steven D. Groff (AFHRL, Lowry AFB, Colo.) Brooks AFB, Texas AFHRL Feb. 1977 56 p refs
(Contract F41609-75-C-0025; AF Proj. 2313)
(AD-A040755; AFHRL-TR-77-8) Avail: NTIS HC A04/MF A01 CSCL 05/10

Norms for Air Force technical training materials were developed for seven previously developed Structure-of-Intellect and seven psycholinguistically oriented variables which have been used to assess the readability/comprehensibility of textual materials. Separate norms are presented for Air Force study guides, manuals, career development course materials, and technical orders. An 'overall' norm is also presented along with norms on the same variables for a small sample of general literature. A multiple linear regression equation, which relates the various comprehensibility measures to measured comprehensibility, was developed and cross-validated. Author (GRA)

N77-29790# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
APPLICATION OF TRACKING TASKS IN ERGONOMIC STUDIES [ZUR ANWENDUNG VON REGELAUFGABEN BEI ERGONOMISCHEN UNTERSUCHUNGEN]
W. Stein and E. Pioch Oct. 1975 136 p refs In GERMAN; ENGLISH summary
(FB-23) Avail: NTIS HC A07/MF A01; Forschungsinst. fuer Anthropotech., Meckenheim, West Ger. DM 10

A classification of presently known tracking task measurement approaches is suggested which includes steady, unsteady, and secondary tracking tasks. Examples of unsteady tasks are critical and adaptive tracking tasks. A multi-purpose test bench for presenting tracking tasks is described. The critical tracking tasks and their various possible applications are explained. The analysis of manual control behavior is facilitated by the use of human operator models. A review and a description of tracking tasks and their use by various investigators is given. Some observations on the reliability and validity of tracking tasks are also presented. Some applications of tracking tasks in various areas of psychology, medicine, and pharmacology are mentioned. Author (ESA)

N77-29791# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
LINEAR MODELS FOR MAN AS CONTROLLER [LINEARE MODELLE FUER DEN MENSCHEN ALS REGLER]
G. Johannsen, H. E. Boller, E. Donges, and W. Stein Nov. 1976 239 p refs In GERMAN
(FB-24) Avail: NTIS HC A11/MF A01

Two approaches are investigated for linear modeling of man as controller based on two essentially different control techniques: quasilinear approach and optimal theoretical approach. Basic concepts in the field of man-machine systems and manual control are explained and general aspects of the model description of man as controller indicated. The quasilinear approach is based on correlation methods and classical frequency range methods. The human frequency characteristic is viewed from a nonparametric and parametric angle. An extended quasilinear model accounting for the physiological properties of extremity motions is described. The optimal theoretical human controller model discussed is based on optimal control and estimation theory. ESA

N77-29792# RAND Corp., Santa Monica, Calif.
THE PEACETIME EVALUATION OF THE PILOT SKILL FACTOR IN AIR-TO-AIR COMBAT Interim Report
Peter DeLeon Jan. 1977 67 p
(Contract F44620-73-C-0011)
(AD-A039880; R-2070-PR) Avail: NTIS HC A04/MF A01 CSCL 05/9

An attempt was made to develop an objective measure for peacetime evaluation of a fighter pilot's air-to-air combat skills. Previous research and combat data from Korea and North Vietnam suggest that the skill of the individual pilot is crucial in the outcome of an aerial engagement. However, it has not been possible to estimate the actual effect or to identify what makes him superior. The Air Force cannot currently evaluate its pilots' air-to-air skills objectively during either their training or operational assignments. This report proposes four research areas that address the effectiveness and evaluation of these pilots: the selection of the prospective pilot from his undergraduate pilot training program, the air-to-air portions of his combat crew training squadron curriculum, the more efficient management of pilot resources, and an examination of the costs and benefits of dissimilar air combat training. It also proposes the development of a pilot skill index. GRA

N77-29793# School of Aerospace Medicine, Brooks AFB, Tex.
OXYGEN REGULATOR PERFORMANCE DURING DECOMPRESSION Interim Report, 1 Dec. 1975 - 31 Aug. 1976
Ronald D. Holden, Bruce F. Hiott, and Paul J. Zalesky Feb. 1977 16 p refs
(AD-A038415; SAM-TR-77-4) Avail: NTIS HC A02/MF A01 CSCL 06/11

Both static and dynamic performance characteristics of standard USAF oxygen regulators were evaluated during simulated decompression (loss of cabin pressurization), using the regulator test stand in conjunction with the decompression chamber at USAFSAM. A total of 10 regulators were tested, combining both torso- and panel-mounted types drawn from the standard USAF inventory. Outlet suction pressure, flow, positive pressure, and delivered oxygen dilution schedules were monitored and evaluated for two different decompression rates (4 and 8 seconds) while simulating the same total pressure change (10.9 psi to 4.4 psi) from 2,438 m to 9,144 m (8,000 to 30,000 ft). General findings indicate an extremely high initial pressure surge at the moment of decompression simultaneous with an immediate drop in the outlet P02 and a subsequent lag time before again maintaining a proper level of oxygen sufficiency at the flyer's mask. A minimum disruptive period of regulator performance was about 10-15 seconds but continued for a considerably longer time in many of the tests. Author (GRA)

N77-29794# Canyon Research Group, Inc., Westlake Village, Calif.
ANALYSIS OF HUMAN FACTORS ENGINEERING EXPERIMENTS: CHARACTERISTICS, RESULTS, AND APPLICATIONS Interim Report
Charles W. Simon Aug. 1976 119 p refs Prepared in cooperation with Hughes Aircraft Co., Culver City, Calif.
(Contracts F44620-76-C-0008; F44620-72-C-0086)
(AD-A038184; CWS-02-76; AFOSR-77-0333TR) Avail: NTIS HC A06/MF A01 CSCL 05/5

Two hundred thirty-nine experiments published in the Journal, Human Factors, during the period from 1958 to 1972 were analyzed for the purpose of discovering the characteristics of their experimental plans, the quality and character of their results, and the degree to which these results had been applied to real systems. The analysis revealed that these experiments investigated too small an experimental space, showed essentially no diversity in their selection of a basic experimental design, collected far more redundant data than was needed, and failed to properly

handle the irrelevant variance arising from sequence effects. When a survey was made of those who conducted the experiments, it was discovered that slightly more than half of the experiments had been done to find answers of general applicability; less than a third were known or believed to have influenced the design of a real system. A majority of the investigators said they would not do their experiments any differently if they were to repeat them today. Some limited discussion on the implications of this analysis for an improved experimental methodology is included. GRA

N77-29795# Naval Undersea Center, San Diego, Calif. Ocean Technology Dept.
MANIPULATOR DEVELOPMENT AT THE NAVAL UNDERSEA CENTER Research and Development Report, 1965-1976
Richard W. Uhrich Jan. 1977 37 p refs
(AD-A038449; NUC-TP-553) Avail: NTIS HC A03/MF A01 CSCL 05/8

An overview of the remote manipulators developed by the Naval Undersea Center since 1965 is presented. Some of the factors affecting the design of manipulators for use at sea are defined, and specific recommendations are made for a manipulator system that would significantly improve the Navy's ability to perform underwater work. Author (GRA)

N77-29796# National Inst. for Occupational Safety and Health, Cincinnati, Ohio. Div. of Technical Services
HEALTH AND SAFETY GUIDE FOR PLUMBING, HEATING, AND AIR CONDITIONING CONTRACTORS
May 1975 131 p
(PB-266409/2; DHEW/PUB/NIOSH-76/127; NIOSH-76-127) Avail: NTIS HC A07/MF A01 CSCL 06J

The guide is intended to assist in providing safe and healthy working conditions for the workers employed by plumbing, heating, and air conditioning contractors. Frequently violated regulations at construction sites include those which pertain to: walking and working surfaces, ladders, trenches, scaffolds, and railings; exits and exit markings; exposure to fibrous material, carbon monoxide, caustics, solvents, other toxic substances, heat, cold, radiation, and noise; personal protective equipment; machinery; portable power tools; and materials handling and storage. Recordkeeping requirements are outlined and checklists included for periodic inspections. GRA

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering.*

N77-29797 Carnegie-Mellon Univ., Pittsburgh, Pa.
PROBLEMS, MECHANISMS AND SOLUTIONS Ph.D. Thesis
Ellis Saul Cohen 1976 160 p
Avail: Univ. Microfilms Order No. 77-7796

Those problems in computational systems that may be solved either by adding a mechanism to a system or by imposing a constraint on the states in which the system is initially permitted to operate are considered. It is found that many such problems can be described as behavioral problems, constraints on the behavior of a system. These problems may be described in a manner that is independent of the particular system. A variety of important protection problems are defined in this way. A formal methodology is developed for solving problems in systems with multiple mechanisms. It is used in developing a number of solutions to a particular protection problem, which are solved by constraining both a protection mechanism (determining acceptable initial protection configurations) and a control mechanism (specifying properties that must be satisfied by programs which are to be excuted by certain users). Finally a variety of constructs for specifying behavioral problems are developed and considerations for analyzing, comparing and measuring solutions to them are discussed. Dissert. Abstr.

N77-29798 Illinois Univ., Urbana-Champaign.
HEURISTICS THAT DYNAMICALLY ALTER DATA STRUCTURES TO REDUCE THEIR ACCESS TIME Ph.D. Thesis
James Richard Bitner 1976 139 p
Avail: Univ. Microfilms Order No. 77-8939

Access times can be significantly reduced if the frequently requested keys occur near the 'top' of the data structure, where they can be quickly accessed. However, the probability of requesting a given key is seldom known a priori and must be observed as requests are made. We consider several heuristics that dynamically alter the data structure by causing frequently requested keys to rise near the 'top' of the data structure, resulting in decreased access times. The two data structures we consider are linked lists and binary search trees. The heuristics are simple and can be cheaply executed. In addition, they significantly reduce the time required to access a key in the data structure. Dissert. Abstr.

N77-29799 Stanford Univ., Calif.
IMPROVING THE THROUGHPUT OF PIPELINES WITH DELAYS AND BUFFERS Ph.D. Thesis
Janak Himatlal Patel 1976 203 p
Avail: Univ. Microfilms Order No. 77-7140

It is characteristic of pipelines that a task can be initiated in the pipeline before an earlier initiated task has completed its execution. A problem arises when two or more tasks try to use the same segment at the same time, causing a collision. Such collisions can be avoided by appropriate scheduling of tasks and/or modification of the pipeline; or the collisions can be resolved at the time and place they occur. These alternatives are studied in this work with the objective that the throughput, i.e., average number of tasks processed per unit time, be maximized while providing considerable flexibility in scheduling of tasks. Collision characteristics of task schedules and pipelines are studied. A methodology for inserting fixed delays in a pipeline to achieve desired collision characteristics is presented. Collisions can be resolved by letting one task use the segment and storing the rest of the competing tasks in a buffer. Dissert. Abstr.

N77-29800 Stanford Univ., Calif.
THE SYNTHESIS OF MANIPULATOR CONTROL PROGRAMS FROM TASK-LEVEL SPECIFICATIONS Ph.D. Thesis
Russell Highsmith Taylor 1976 229 p
Avail: Univ. Microfilms Order No. 77-7174

For manipulator programming, the principal elements of planning information are: (1) descriptive information about the objects being manipulated; (2) situational information describing the execution-time environment; and (3) action information defining the task and the semantics of the execution-time environment. A standard subtask in mechanical assembly, insertion of a pin into a hole, is used to focus the technical issues of automating manipulator coding decisions. This task is first analyzed

from the point of view of a human programmer writing in the target language, AL, to identify the specific coding decisions required and the planning information required to make them. Then, techniques for representing this information in a computationally useful form are developed. Procedures are developed which use this planning information to generate AL code automatically. The AL system itself performs a number of coding functions not normally found in algebraic compilers. These functions and the planning information required to support them are also discussed. Dissert. Abstr.

N77-29801*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PACE 2: PRICING AND COST ESTIMATING HANDBOOK
Rodney D. Stewart and Tom Shepherd Jul. 1977 61 p
(NASA-TM-78121) Avail: NTIS HC A04/MF A01 CSCL 09B

An automatic data processing system to be used for the preparation of industrial engineering type manhour and material cost estimates has been established. This computer system has evolved into a highly versatile and highly flexible tool which significantly reduces computation time, eliminates computational errors, and reduces typing and reproduction time for estimators and pricers since all mathematical and clerical functions are automatic once basic inputs are derived. Author

N77-29802# Federal COBOL Compiler Testing Service, Washington, D. C.
VALIDATION SUMMARY REPORT, DECSYSTEM-20 COBOL
4 May 1977 78 p
(AD-A040227; CCVS74-VSR195) Avail: NTIS HC A05/MF A01 CSCL 09/2

This Validation Summary Report (VSR) for the DECSYSTEM-20 (CBL74) COBOL Compiler Version 1A (TOPS-20 Version V2) provides a consolidated summary of the results obtained from the validation of the subject compiler against the 1974 COBOL Standard (X3.23-1974/FIPS PUB 21-1). The compiler was validated at the High level of FIPS PUB 21-1. The VSR is made up of several sections showing the discrepancies found. These include an overview of the validation which lists all categories of discrepancies by level/module within X3.23-1974; a section relating the categories of discrepancies to each of the Federal levels of the language; and a detailed listing of discrepancies together with the tests which were failed.
Author (GRA)

N77-29803# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
COMPUTER SYSTEMS WITH A VERY LARGE ADDRESS SPACE AND GARBAGE COLLECTION Ph.D. Thesis
Peter B. Bishop May 1977 280 p refs
(Contract N00014-75-C-0522)
(AD-A040601; MIT-LCS-TR-178) Avail: NTIS HC A13/MF A01 CSCL 09/2

The concept of objects is beginning to gain acceptance throughout the field of computer science. A new computer system is proposed that provides hardware support for objects and object references that can be used in all applications of objects. The new system provides a small object references that can be copied freely, makes very small objects efficient, and retrieves the storage for inaccessible objects automatically. This system is compared with some widely used existing systems, and while its speed seems to be competitive, it is much easier to use. Object references provide protection in the new system as do capabilities in capability systems. The object reference in the new system contains an address from a linear, paged virtual address space rather than a unique ID. Use of small objects is made feasible by efficiently grouping objects into areas. Objects in the same area may be placed on the same page. The system automatically and efficiently manitains lists of inter-area links that allow single areas to be garbage collected independently of the rest of the system. The garbage collector can determine whether objects have been inappropriately placed in an area and can move these objects to more appropriate areas automatically. Author (GRA)

N77-29804# Federal COBOL Compiler Testing Service, Washington, D. C.
FORTRAN COMPILER VALIDATION SUMMARY REPORT. HONEYWELL LEVEL 66, FORTRAN VERSION 3I
26 May 1977 20 p
(AD-A040083; FCVS66-VSR190) Avail: NTIS HC A02/MF A01 CSCL 09/2

This Validation Summary Report (VSR) for the Honeywell Level 66 FORTRAN Compiler Version 3I (GCOS Version 3I) provides a consolidated summary of the results obtained from the validation of the subject compiler against the 1966 FORTRAN Standard (X3.9-1966). The VSR is made up of several sections showing the discrepancies found. These include an overview of the validation which lists all categories of discrepancies; a section relating the categories of discrepancies to the language; and a detailed listing of discrepancies together with the tests which were failed. Author (GRA)

N77-29805# Mitre Corp., Bedford, Mass.
WWMCCS H6000 MULTIPROCESSOR PERFORMANCE EVALUATION, VOLUME 1 Final Report
George A. Nelson L. G. Hanscom Field, Mass. ESD Feb. 1977 178 p refs 2 Vol.
(Contract F19628-77-C-0001; AF Proj. 2188)
(AD-A039111; MTR-3350-Vol-1; ESD-TR-77-18-Vol-1; AFDSDC-STS-3-77-Vol-1) Avail: NTIS HC A09/MF A01 CSCL 09/2

An overall description of the multiprocessor performance evaluation task is presented. This task involved the collection and analysis of empirical data from controlled performance tests using synthetic workloads on H6000 computer systems comprised of from one to four central processing units. Described is the rationale for initiating the task, the technical approach, the test results, and a summary of limitations, observations and applicability. Author (GRA)

N77-29806# Mitre Corp., Bedford, Mass.
WWMCCS H6000 MULTIPROCESSOR PERFORMANCE EVALUATION, VOLUME 2 Final Report
George A. Nelson L. G. Hanscom Field, Mass. ESD Feb. 1977 143 p 2 Vol.
(Contract F19628-77-C-0001; AF Proj. 2188)
(AD-A039368; MTR-3350-Vol-2; ESD-TR-77-18-Vol-2; AFDSDC-STS-3-77-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 09/2

Detailed test data are provided. The goal of the task was to determine the relative throughput of several different H6000 multiprocessor configurations for different types of workloads. This information is being used by planners when trying to determine the best way to satisfy increasing workload requirements for existing computer systems. Author (GRA)

N77-29807# Mitre Corp., Bedford, Mass.
INTEGRITY CONSIDERATIONS FOR SECURE COMPUTER SYSTEMS
K. J. Biba Apr. 1977 67 p refs
(Contract F19628-75-C-0001; AF Proj. 522B)
(AD-A039324; MTR-3153-Rev-1; ESD-TR-76-372) Avail: NTIS HC A04/MF A01 CSCL 09/2

An integrity policy defines formal access constraints which, if effectively enforced, protect data from improper modification. The author identifies the integrity problems posed by a secure military computer utility. Integrity policies addressing these problems are developed and their effectiveness evaluated. A prototype secure computer utility, Multics, is then used as a testbed for the application of the developed access controls.
GRA

N77-29808# University of Southern Calif., Los Angeles. Dept. of Aerospace Engineering.
PIPELINE, PARALLEL AND SERIAL REALIZATION OF PHASE DEMODULATORS Interim Report
Richard S. Bucy, Kenneth D. Senne, and Hussein Youssef 22 Nov. 1976 70 p refs
(Contracts F44620-76-C-0085; AF-AFOSR-2141-71)
(AD-A039337; AFOSR-77-0576TR; Rept-76-31) Avail: NTIS HC A04/MF A01 CSCL 09/2

Timing results for the CDC 6600, 7600, Star, the Illiac, PDP11-70, IBM 370-168 and presented for the phase demodula-

tion problem. Architectural features of the machines and their impact on fast software are discussed. Author (GRA)

N77-29809# Rome Air Development Center, Griffiss AFB, N.Y.
CONSIDERATIONS IN THE DESIGN OF A SECURE DATA BASE MANAGEMENT SYSTEM In-House Report, May 1974 - Feb. 1976
William E. Rzepka Mar. 1977 35 p refs
(AD-A039169; RADC-TR-77-9) Avail: NTIS HC A03/MF A01 CSCL 09/2

Consideration is given to several problems encountered in the design of a secure, multilevel Data Base Management System (DBMS). The DBMS will operate within the environment of a certified, secure operating system which will implement and enforce the Department of Defense Information Security Program for protection of classified information. A set of DBMS security requirements is used as basis for design considerations, and the economic and functional impact of these requirements is assessed. Areas of consideration include: data organization and structure, operations on structured data, coordinated data sharing and data entry. On the basis of these considerations, it is concluded that relational data systems minimize the impact of the DBMS security requirements on the functional capabilities of a DBMS. These same requirements are found, however, to increase the costs of coordinated data sharing, and to present difficult problems in multilevel data entry. GRA

N77-29810# Federal COBOL Compiler Testing Service, Washington, D. C.
FEDERAL COBAL COMPILER TESTING SERVICE COMPILER VALIDATION REQUEST INFORMATION
9 May 1977 40 p refs
(AD-A040676; FCCTS/TR-77/05) Avail: NTIS HC A03/MF A01 CSCL 09/2

This document provides information regarding the Federal COBOL Standard and all of the Government regulations associated with it. It discusses the background of the Federal COBOL Compiler Testing Service which was set up by a memorandum of agreement between the National Bureau of Standards and the Department of Defense delegating the authority to validate all COBOL compilers brought into the Federal inventory. The report discusses both the 1968 (FIPS PUB 21) and 1974 (FIPS PUB 21-1) COBOL Standards, the Federal Property Management Regulations regarding the implementation of FIPS PUB 21-1 as a Federal Standard, and the requirement of COBOL compiler validation in the procurement process. It also contains a list of all software products produced by the software Development Division in support of the FCCTS as well as the Validation Summary Reports produced as a result of discharging the responsibility delegated by the NBS-DOD agreement. Note that the FCCTS should be contacted to receive the latest information regarding software products and VSR. Author (GRA)

N77-29811# Harvard Univ., Cambridge, Mass. Aiken Computation Lab.
RESEARCH ON VIRTUAL MACHINES Final Technical Report, Jun. 1975 - Oct. 1976
Ugo O. Gagliardi and R. K. Jain Griffiss AFB, N. Y. RADC May 1977 91 p refs
(Contract F30602-76-C-0001)
(AD-A040466; RADC-TR-77-57) Avail: NTIS HC A05/MF A01 CSCL 09/2

A Virtual Machine Monitor for a PDP 11/40 mini-computer is being developed for research purposes. A Virtual I/O module, and a portion of the VMM Kernal have been developed. The VMM provides virtual I/O to several I/O devices like Disc, tape, printer, etc. via an X-Bus connected to a PDP/10. The VMM also provides multiple virtual machine structures so that these virtual devices can be divided among various virtual machines in any desired manner. Author (GRA)

N77-29812# Rockwell International Corp., Newport Beach, Calif. Collins Government Telecommunications Div.
AN ARCHITECTURAL STUDY OF SIGNAL PROCESSING SYSTEMS AND SWITCHED NETWORKS. VOLUME 2: APPENDICES Final Report, 16 Aug. 1976 - 15 Mar. 1977
15 Mar. 1977 184 p refs
(Contract DCA100-76-C-0070)
(AD-A040283) Avail: NTIS HC A09/MF A01 CSCL 09/2

Contents: Parallel Bus Architecture; Serial Bus Architecture; Matrix Switch Architecture; Array Processors; Parameters for Module Specification; Architecture Selection Criteria; Signal Processing Target System; Switching Target System; Architecture Selection for Signal Processing Systems; Architecture Selection for Switching Systems; Signal Processing Modules; Functional Modules of a Message Switch; Simulation Program Flowcharts; Computer Listings and Runs; Language Selection; and Bibliography. GRA

N77-29813# Rockwell International Corp., Newport Beach, Calif. Collins Government Telecommunications Div.
AN ARCHITECTURAL STUDY OF SIGNAL PROCESSING SYSTEMS AND SWITCHED NETWORKS. VOLUME 3, APPENDIX L: COMPUTER LISTINGS AND RUNS Final Report, 16 Aug. 1976 - 15 Aug. 1977
15 Mar. 1977 177 p
(Contract DCA100-76-C-0070)
(AD-A040284) Avail: NTIS HC A09/MF A01 CSCL 09/2

Contents: Program listing of the general simulation model for a bus architecture (FMODEL); Program listing of the Report formater (FREPORT); Listing of the Signal Processing Module library (SPMODULE); Listing of the Switching System Module library (SWMODULE); Listing of Signal Processing Simulation Runs; and Listings of Switching System Simulation Run. GRA

N77-29814# Federal COBOL Compiler Testing Service, Washington, D. C.
VALIDATION SUMMARY REPORT IBM 360/370 FORTRAN 4 H
17 May 1977 22 p refs
(AD-A040385; FCVS66-VSR205) Avail: NTIS HC A02/MF A01 CSCL 09/2

This Validation Summary Report (VSR) for the IBM 360/370 'H' FORTRAN Compiler Version 21.8 (OS Version 21.8) provides a consolidated summary of the results obtained from the validation of the subject compiler against the 1966 FORTRAN Standard (X3.9-1966). The VSR is made up of several sections showing the discrepancies found. These include an overview of the validation which lists all categories of discrepancies; a section relating the categories of discrepancies to the language; and a detailed listing of discrepancies together with the tests which were failed. Author (GRA)

N77-29815# McDonnell-Douglas Astronautics Co., Titusville, Fla.
ENVIRONMENTAL TESTING OF A FLUIDIC DIGITAL-TO-ANALOG CONVERTER, VOLUME 1 Final Report
George W. Roe Jul. 1976 106 p 2 Vol.
(Contract DAAG39-74-C-0212; DA Proj. 1T1-62114-A-644)
(AD-A040871; MDC-L0356-Vol-1; HDL-CR-76-212-1-Vol-1)
Avail: NTIS HC A06/MF A01 CSCL 09/5

This report documents the results of a test program to investigate the performance of the fluidic subsystem when subjected to environmental extremes. Twenty-one fluidic digital to analog convertors were subjected to the environments of High Temperature, Low Temperature, Acceleration, Vibration, Acoustical Noise and Altitude, and their performance compared to baseline data. The results are presented, for each unit, in the form of histograms. Author (GRA)

N77-29816# Gaertner (W. W.) Research, Inc., Stamford, Conn.
DESIGN, CONSTRUCTION AND INSTALLATION OF DATA MANIPULATOR Final Technical Report
W. W. Gaertner, D. T. W. Lee, C. T. Retter, and I. M. Singh Griffiss AFB, N. Y. RADC May 1977 91 p
(Contract F30602-75-C-0290)
(AD-A040588; RADC-TR-77-166) Avail: NTIS HC A05/MF A01 CSCL 09/2

It is by now well recognized that most parallel processing systems require a versatile communication facility to pass data: (1) between the different processing elements, (2) between the processing elements as a group and the memory modules, and (3) between the input/output devices and memory and/or processing elements. This communication capability is used to exchange data (such as interim results) between processing elements, to rearrange data in memory, and even to rearrange

bits within the same parallel word. The term Data Manipulation has been introduced to define this function which must be considered a computer-system building block of equal importance to the processing element array, the high speed memory, the mass storage and the system control. Surprisingly, this fact has not been recognized adequately in the design of several existing parallel-processor systems, with the result that the execution of many important algorithms is slowed down significantly. This report describes the design, construction, installation and performance of a Data Manipulator which, while integrated specifically into a STARAN computer system, is applicable to any other parallel computer architecture. GRA

N77-29817# Rockwell International Corp., Newport Beach, Calif. Collins Government Telecommunications Div.
AN ARCHITECTURAL STUDY OF SIGNAL PROCESSING SYSTEMS AND SWITCHED NETWORKS, VOLUME 1 Final Report, 16 Aug. 1976 - 15 Mar. 1977
15 Mar. 1977 147 p
(Contract DCA100-76-C-0070)
(AD-A040282) Avail: NTIS HC A07/MF A01 CSCL 09/2

A modular design process as applied to signal processing and switching systems is described. Architecture analysis, high order language evaluation and comparison, system simulation, and hardware/software tradeoffs were made in the context of modular design of signal processing and switching systems. The principal motivation for modular system design is lower life cycle cost. Author (GRA)

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N77-29818 Stanford Univ., Calif.
CONSTRUCTING AND DEBUGGING MANIPULATOR PROGRAMS Ph.D. Thesis
Raphael Ari Finkel 1976 172 p
Avail: Univ. Microfilms Order No. 77-7086

A theoretical framework is described for the principal issues involved in computer control of manipulators, including types of manipulators, specification of destinations, trajectory specification and planning, methods of interpolation, force feedback, force application, adaptive control, collision avoidance, and simultaneous control of several manipulators. An implementation manual for the AL manipulator programming language is also presented. The goals of the language are discussed, the language is defined, the compiler described, and the execution environment detailed. The problems involved in programming in the AL language are discussed, including program preparation, compilation, and debugging. Dissert. Abstr.

N77-29819 Carnegie-Mellon Univ., Pittsburgh, Pa.
LIST STRUCTURE: MEASUREMENTS, ALGORITHMS, AND ENCODING Ph.D. Thesis
Douglas Wells Clark 1976 177 p
Avail: Univ. Microfilms Order No. 77-7795

A study was made of list structures: how they are used in practice, how they can be moved and copied efficiently, and how they can be represented by space-saving encodings. The approach taken to these subjects is mainly empirical. Measurement results are based on five large programs written in Interlisp, a sophisticated Lisp system that runs on the PDP-10. Static data were collected at the end of typical runs of the programs, and all list structure used as data by them was measured (about 50,000 cells each). Strong regularities were discovered. In each program, about one-third of all cars pointed to lists, the rest mainly to literal atoms and small integers; roughly three-fourths of cdrs pointed to lists, the rest mainly to the atom NIL. List pointers generally pointed to a location physically nearby in memory, a condition that appears to depend only on the sequential allocation of new list cells. Atom pointers were distributed approximately according to Zipf's law, which models word occurrence in natural language text. Dissert. Abstr.

N77-29820 Purdue Univ., Lafayette, Ind.
THEORETICAL DESCRIPTION OF AN ACCESS LANGUAGE FOR A GENERAL DECISION SUPPORT SYSTEM Ph.D. Thesis
Robert Henry Bonczek 1976 216 p
Avail: Univ. Microfilms Order No. 77-7419

An access language for the GPLAN system is studied. Various forms of the logical structure of the knowledge base are considered, and all are found equivalent, in particular the CODASYL network data model and the Relational data model. A linguistic characterization of a logical data structure is given, providing one basis for data base design. The GPLAN Mapping Language is defined linguistically using a transformational grammar. Special interactive inverse transformations provide a user-directed means of relationship evaluation. Other transformations provide data access security, thus incorporating the security aspects of the system into the language definition. A semantic net is implemented within the data base framework, with simple extensions and modifications. Data nodes of the semantic net are also replaced by programs, allowing the construction of models. The language is thus further extended, since reference to a program in the semantic net causes the execution of that program. The programs are self-documenting. Dissert. Abstr.

N77-29821 Wisconsin Univ., Madison.
EMPIRICAL STUDIES OF NOUN MEANING FOR COMPUTATIONAL MODELS OF UNDERSTANDING Ph.D. Thesis
John Boyce Bennett, Jr. 1976 238 p
Avail: Univ. Microfilms Order No. 76-29902

A central problem for computational models of understanding is to formalize the meanings of words manipulated by the model. Research directed towards the formalization of the meanings of nouns is described. The goal is to describe nouns sufficiently to enable the performance of a particular task of understanding: the selection of appropriate verb senses for multiply-sensed verbs. The hypothesis tested is that noun meaning can be described by primitive units of meaning, called features. Empirical methods of analysis are developed and a general set of features is generated. Dissert. Abstr.

N77-29822 Purdue Univ., Lafayette, Ind.
PROGRAM BEHAVIOR AND LOAD DEPENDENT SYSTEM PERFORMANCE Ph.D. Thesis
Kevin Comerford Kahn 1976 222 p
Avail: Univ. Microfilms Order No. 77-7474

A simple network based on the simple, classical, life-time-function description of program behavior is used to study three heuristics for controlling the load to optimize throughput. A more realistic phase/transition program behavior model is developed from intuitive bases. Actual program data is used to validate this model. Finally, the model is used to derive a more complex queueing network for the system. For those measures defined and computable in the simple model, this complex network is shown to yield identical results. The complex model is then applied to study the stability of the control heuristics. The main conclusions are that simple heuristics seem capable of maintaining a system at a load that generates optimal througput, that adequate program models should decompose behavior into aspects that result from stable and transitory activity, and that the range of applicability of a very simple queueing model is considerably broader than it may first appear. Dissert. Abstr.

N77-29823 Illinois Univ., Urbana-Champaign.
THE PASCAL-11 PROGRAMMING SYSTEM Ph.D. Thesis
Arthur Ian Stocks 1976 112 p
Avail: Univ. Microfilms Order No. 77-9202

The design and implementation of a PASCAL-based programming system on the PDP-11 minicomputer. The system consists of a compiler for the language PASCAL-11, written in itself, together with a set of MACRO-11 routines which transform a PDP-11 into a virtual PASCAL machine. Extensive diagnostic support and performance monitoring facilities are provided to allow easy debugging and optimisation of PASCAL-11 programs. A number of extensions were made to the base language PASCAL, including augmentation of the file handling abilities of the language in an operating system independent manner. This dialect of PASCAL allows easy separation of a program into overlays; the

run time overlay management system is completely automatic and transparent to the user. Dissert. Abstr.

N77-29824 Stanford Univ., Calif.
THEOREM PROVING AND SEMANTIC TREES Ph.D. Thesis
David Alan Plaisted 1976 226 p
Avail: Univ. Microfilms Order No. 77-7145

Orderings, paths, and homomorphisms on semantic trees with variables are examined. These concepts arise repeatedly in completeness proofs. A semantic tree with variables is a resolution proof tree in which the literals of the input clauses are distributed among the arcs of the tree. The literals are distributed in a way corresponding to the way the literals are used in the resolution proof tree. A homomorphism is a mapping from the literals of one tree to the literals of another tree that preserves certain structure. A path is a sequence of ordered pairs of literals in which the two literals in each ordered pair must have descendents that resolve against one another. Also, the second literal of an ordered pair in the path and the first literal of the next ordered pair in the path must be distinct literals from the same clause. Dissert. Abstr.

N77-29825 Florida Univ., Gainesville.
A VARIABLE-ORDER NONLINEAR PROGRAMMING ALGORITHM FOR USE IN COMPUTER-AIDED CIRCUIT DESIGN AND ANALYSIS Ph.D. Thesis
Alberto Jose Jimenez 1976 295 p
Avail: Univ. Microfilms Order No. 77-6881

An iterative algorithm, called the variable-order (VO) algorithm, is derived for computing a local minimum of a nonlinear function of several independent variables. The VO algorithm is shown to be very competitive with several existing algorithms. The class of functions for which the algorithm is globally convergent is established. It is shown that the VO algorithm converges with order as high as four. A major step of the algorithm is the solution of a scalar problem that may be along curved trajectories in the space of the independent variables, instead of along straight lines as in most existing algorithms. Approximations to required higher-order derivatives are given which allow the use of the VO algorithm even if only function values can be supplied. If the supplied function and gradient values are somewhat inaccurate, as is often the case in computer-aided circuit optimization procedures, the VO algorithm is shown to be still effective. Dissert. Abstr.

N77-29826*# George Washington Univ., Washington, D.C. Dept. of Electrical Engineering and Computer Science.
PROVING THE CORRECTNESS OF THE FLIGHT DIRECTOR PROGRAM EADIFD, VOLUME 1
Frank J. Lee and W. D. Maurer Jul. 1977 127 p refs
(Grants NsG-1170; NSF DCR-73-03431-A01)
(NASA-CR-153898) Avail: NTIS HC A07/MF A01 CSCL 09B

EADIFD is written in symbolic assembly language for execution on the C4000 airborne computer. It is a subprogram of an aircraft navigation and guidance program and is used to generate pitch and roll command signals for use in terminal airspace. The proof of EADIFD was carried out by an inductive assertion method consisting of two parts, a verification condition generator and a source language independent proof checker. With the specifications provided by NASA, EADIFD was proved correct. The termination of the program is guaranteed and the program contains no instructions that can modify it under any conditions. J.L.H.

N77-29827*# George Washington Univ., Washington, D.C. Dept. of Electrical Engineering and Computer Science.
PROVING THE CORRECTNESS OF THE FLIGHT DIRECTOR PROGRAM EADIFD. VOLUME 2: PROOFS OF PATHS 1-29 Final Technical Report
Frank J. Lee Jul. 1977 108 p refs
(Grant NsG-1170)
(NASA-CR-153399) Avail: NTIS HC A06/MF A01 CSCL 09B

For abstract, see N77-29826.

N77-29828# Lockheed-California Co., Burbank.
SUMMARY OF 1976 INDEPENDENT RESEARCH ON ENGINEER ORIENTED REMOTE COMPUTING
R. W. Lingard 30 Jun. 1977 69 p refs
(LR-28005) Avail: NTIS HC A04/MF A01

A computer system has been designed and partially implemented to provide a software interface between users, possibly inexperienced in computer processing techniques, and available programs and analysis systems. This system, denoted as ASSIST (A Scientific Software Interface System for Terminal-users), aids users in accessing and utilizing existing applications software from remote terminals. The system provides three basic functions. It helps users find programs relevant to their problems; it assists them in preparing required input data; and it aids in the actual submittal of programs and data for computer processing. In addition, the system monitors usage of the facilities and provides information for aiding management in making decisions for ensuring the efficient and proper use of available computer resources. Author

N77-29829# Cologne Univ. (West Germany). Inst. fuer Geophysik un Meteorologie.
FUNCTIONAL AND TESTING PROBLEM OF APPLICATION PROGRAMS FOR DIGITAL COMPUTERS. VALIDITY OF EXEMPLARY TESTS [ZUM FUNKTIONS- UND TESTPROBLEM BEI ANWENDUNGSPROGRAMMEN FUER DIGITALRECHNER. UEBER DEN AUSSAGEWERT EXEMPLARISCHER TESTS]
Helmut Zschoerner Mar. 1975 35 p refs In GERMAN
(Mitt-22) Avail: NTIS HC A03/MF A01

The problem of absolute programming error control was dealt with, emphasizing applications programs for digital computers. The test methods presently used for computer programs were investigated. It is shown that single results of exemplary computations generally cannot lead to the conclusion that the program is without errors. Additional conditions for improving the test situation and some deductions therefrom are discussed, and starting points for a more generalized solution of the problem are indicated. ESA

N77-29830# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
COMPACT CODING OF BINARY TREES WITH PAIRING FUNCTIONS [KOMPAKTE CODIERUNG VON BINAERBAEUMEN MIT PAARAUFZAEHLUNGSFUNKTIONEN]
U. Klemm Feb. 1977 53 p refs In GERMAN; ENGLISH summary
(FFM-249) Avail: NTIS HC A04/MF A01

The information gain by coding the binary tree as an expression in terms of some pairing functions is considered. Given a coded tree, universal upper and lower bounds for its height are derived. Some more detailed results are proved for a special class of pairing functions. Author (ESA)

N77-29831# Institute for Defense Analyses, Arlington, Va. Program Analysis Div.
DOCUMENTATION OF CURRENT IDA COMPUTER MATERIAL DEVELOPED FOR DCPA, VOLUME 2
Leo A. Schmidt Jan. 1977 236 p refs
(Contract DCPA01-76-C-0213)
(AD-A039819; IDA/HQ-77-19226-Vol-2) Avail: NTIS HC A11/MF A01 CSCL 15/4

This paper is a documentation of computer materials developed by the Institute for Defense Analyses (IDA) for use by the Defense Civil Preparedness Agency (DCPA). All IDA physical data processing materials (IBM cards, magnetic tape, computer printouts) have been surveyed and catalogued. All computer programs are written in FORTRAN (a general knowledge of this language is assumed in the detailed descriptions contained herein). Computer programs considered useful by IDA have been included and documented. A group of general purpose subprograms are described, along with their interfaces with the using programs. Data file formats also have been developed, along with programs for managing these files. Such programs and resulting files are described in detail. Author (GRA)

N77-29832# Institute for Defense Analyses, Arlington, Va.
DOCUMENTATION OF CURRENT IDA COMPUTER

MATERIAL DEVELOPED FOR DCPA, VOLUME 3
Leo A. Schmidt Jan. 1977 160 p
(Contract DCPA01-76-C-0213)
(AD-A039820; IDA/HG-77-19227) Avail: NTIS HC A08/MF A01 CSCL 15/4

In surveying the IDA data files two facts soon became apparent: (1) the data files were quite varied in format, and the format of a file, while possibly desirable for its original use, was arbitrary for current uses, and (2) it was not possible to trace the source of many data files--there was no well established audit trail from original sources to the present file. In order to usefully document data files three requirements soon became apparent: (1) A standardization of data file formats to the greatest degree consistent with efficient processing of the resulting file, (2) A documentation procedure so the history of the file could be followed, and (3) An efficient way of manipulating and handling data files. GRA

N77-29833# General Research Corp., Santa Barbara, Calif.
JAVS TECHNICAL REPORT. USERS GUIDE Final Report, May - Nov. 1976
C. Gannon, N. B. Brooks, and R. J. Urban Apr. 1977 109 p
(Contract F30602-76-C-0233)
(AD-A040103; RADC-TR-77-126-Vol-1) Avail: NTIS HC A06/MF A01 CSCL 09/2

The JOVIAL Automated Verification System (JAVS) is a tool for analyzing source programs written in the J3 dialect of the JOVIAL language. From the user's viewpoint, JAVS consists of a sequence of processing steps which (1) analyze his JOVIAL source text, (2) guide him in preparing test cases for his code, (3) analyze the results of tests executed by his code, and (4) automatically document his code. The purpose of this document is to introduce the tester to JAVS and to the process of software testing supported by JAVS. The information provided in this guide on JAVS usage is intentionally limited to the beginning user. The appendices provide the information necessary for operating JAVS at RADC and can be referenced by the sophisticated as well as the beginning user. The information presented on the testing methodology which JAVS supports is applicable to both the beginning and sophisticated user of JAVS. Author (GRA)

N77-29834# General Research Corp., Santa Barbara, Calif.
JAVS TECHNICAL REPORT. REFERENCE MANUAL Final Report, May - Nov. 1976
C. Gannon and N. B. Brooks Apr. 1977 209 p refs
(Contract F30602-76-C-0233)
(AD-A040104; RADC-TR-77-126-Vol-2) Avail: NTIS HC A10/MF A01 CSCL 09/2

The purpose of this document is to describe in detail JAVS processing and each of the JAVS commands. The organization of the Reference Manual follows a top-down approach. Starting with a system level description in the first section, each subsequent section describes a subset of the total system in detail. GRA

N77-29835# Naval Ship Research and Development Center, Bethesda, Md. Computation Mathematics/Logistics Dept.
EDIT: A FORTRAN PROGRAM MAINTENANCE SYSTEM FOR THE TEXAS INSTRUMENTS ASC-7
Paul Morawski Mar. 1977 14 p
(AD-A039180; CMLD-77-07) Avail: NTIS HC A02/MF A01 CSCL 09/2

EDIT is a MACRO program for automatic maintenance of FORTRAN and RATFOR (Rational FORTRAN) programs on the Texas Instruments Advanced Scientific Computer. It has been used extensively to accelerate the creation of complex fluid dynamics programs for execution on the Advanced Scientific Computer (ASC). EDIT allows the user to more efficiently create and modify programs using the TI-supplied Source Managment System, SMS. Object libraries and load modules may also be automatically updated. The program files (source, object, and load module) have a user-specified number of versions retained as backup. The files may be tape or disk resident. The EDIT system is described and sample usages are presented. Author (GRA)

N77-29836# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Civil Engineering.
REPRESENTATION OF A COMPUTER-AIDED ITERATIVE DESIGN PROCESS M.S. Thesis
Martin A. Tamm and Steven T. Fenves Apr. 1977 51 p refs
(Contract N00014-76-C-0354)
(AD-A039384; R-77-5) Avail: NTIS HC A04/MF A01 CSCL 09/2

A network representation of the iterative design process has been presented. The representation is closely based on that previously developed for non-iterative design checking. The representation uses two sets of data values, denoted as Level 1 and Level 2, in a manner similar to first-order iterative computational schemes. Certain data values, designated internally modifiable parameters, serve as a reference between successive cycles. Provisions are made for retaining certain data between cycles, so as to suppress calculations in some iterations, when it is felt that the results are insensitive to changes in certain data values. The representation is illustrated through the application to a typical structural design problem. Detailed data structures and transformation process are presented. In the case of data, it is shown that the subscripted nature of the data must be explicitly taken into account, whereas the non-iterative process can be represented in terms of generic, or unsubscripted, data. The recursive procedures for evaluating and modifying data have been extended to handle the two-level, subscripted data representation. Four additional processes are defined: Those to ACCEPT or REJECT the current cycle of results, and those to RETAIN and RELEASE data between cycles. Author (GRA)

N77-29837# Watervliet Arsenal, N.Y.
VERIFICATION OF NUMERICALLY CONTROLLED MACHINE PROGRAMS BY THE AUTOMATIC DRAFTING MACHINE
D. Concordia Mar. 1977 54 p
(AD-A039619; WVT-TR-77011) Avail: NTIS HC A04/MF A01 CSCL 09/2

This is a report on the modifications made to the Gerber automatic drafting program to allow for the verification of numerical controlled machine programs on the automatic drafting machine. Programming changes were made so that the eleven most-used machines at Watervliet Arsenal can be verified. Author (GRA)

N77-29838# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
TENEX MSG USER MANUAL Technical Report, 1 Aug. 1976 - 30 May 1977
Robert H. Thomas and Paul R. Johnson Apr. 1977 32 p
(Contract N00014-75-C-0773; ARPA Order 2935)
(AD-A039599; BBN-3540) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report describes the implmentation of MSG, the interprocess communication facility for the National Software Works (NSW) system, for the (TENEX) system. It is intended as a reference for programmers who use MSG and as a guide for those responsible for the operation of systems, such as NSW, which uses MSG. Author (GRA)

N77-29839# Rensselaer Polytechnic Inst., Troy, N. Y. Computer Research Lab.
AN IMPLEMENTATION OF THE LOUTREL HIDDEN-LINE ALGORITHM
Michael Potmesil Sep. 1976 65 p refs
(Grant AF-AFOSR-2937-76; AF Proj. 2304)
(AD-A036401; CRL-49; AFOSR-77-0104TR) Avail: NTIS HC A04/MF A01 CSCL 09/2

This report describes an implementation of a variation of the hidden-line algorithm developed by P. Loutrel. The new algorithm produces hidden-line drawings of scenes composed of opaque polyhedra as well as of some more general types of flat-faced objects not covered by the original Loutrel algorithm. The program is written in FORTRAN IV and has been implemented in a batch version on a CDC 6600 computer and in an interactive version on an ADAGE AGT-30 interactive graphics computer. Author (GRA)

N77-29840# Illinois Univ., Urbana-Champaign. Coordinated Science Lab.

A DESIGN LANGUAGE FOR MODULAR ASYNCHRONOUS CONTROL STRUCTURES
Trevor Mudge and Gernot Metze Feb. 1977 66 p refs
(Contract DAAB07-72-C-0259)
(AD-A040684; UICU-ENG-77-2206; CR-759) Avail: NTIS HC A04/MF A01 CSCL 09/2

A design language for asynchronous digital systems is presented. The language translates onto a set of asynchronous logic modules, to form the control structure of a digital system. The behavior of these modules is discussed. The process of translating the design language into networks of these modules is outlined. An example design is presented. The design language is shown to be able to describe machines having all the capabilities normally required of a microcontroller, as well as the capability to describe the control of parallel processes without necessarily binding processes to one another. Parallel processes imply the possibility of designing a system having the potential for deadlock. It is shown, in a quantitative way, that it is easier to check a design described by the design language for correct syntax and absence of deadlock, than to check an arbitrary network of modules for absence of deadlock. It is inferred from this, that fault-free design is easier using the design language.
Author (GRA)

N77-29841# Gaertner (W. W.) Research, Inc., Stamford, Conn.
IMPACT OF STRUCTURED PROGRAMMING STANDARDS ON SMALL GOVERNMENT CONTRACTORS, VOLUME 1 Final Technical Report, Aug. 1976 - Feb. 1977
Wolfgang W. Gaertner Griffiss AFB, N. Y. RADC May 1977 52 p refs
(Contract F30602-76-C-0390)
(AD-A040771; RADC-TR-77-162-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 05/1

A study of the impact of the structured programming standards on small government contractors. How they can reasonably meet such requirements within the normal environment of the small contractor.
Author (GRA)

N77-29842# Gaertner (W. W.) Research, Inc., Stamford, Conn.
IMPACT OF STRUCTURED PROGRAMMING STANDARDS ON SMALL GOVERNMENT CONTRACTORS, VOLUME 2 Final Technical Report, Aug. 1976 - Feb. 1977
Wolfgang W. Gaertner Griffiss AFB, N. Y. RADC May 1977 240 p refs
(Contract F30602-76-C-0390)
(AD-A040828; RADC-TR-77-162-Vol-2) Avail: NTIS HC A11/MF A01 CSCL 05/1

Volume II contains the detailed comments prepared during a line-by-line review of the entire Structured Programming Series. Analyses, clarifications and recommendations are provided wherever the original text is not self-explanatory. In addition, examples for the implementation of the various requirements in the Structured Programming Series are presented in all cases where the effort required was minimal.
GRA

N77-29843# Automatic Data Processing Equipment Selection Office (Navy), Washington, D. C.
COBOL COMPILER VALIDATION SYSTEM, 1974. VERSION 2.0 IMPLEMENTATION DOCUMENTATION, USERS GUIDE
Feb. 1977 197 p Supersedes AD-A017940
(AD-A036174; USN-CCVS74/02; DOD/DE-77/002A) Avail: NTIS HC A09/MF A01 CSCL 09/2

This document represents the implementation information necessary to implement Version 2.0 of the 1974 U.S. Navy Cobol Compiler Validation System (CCVS). The 1974 CCVS will consist of audit routines, their related data, and an executive routine (VP-routine) which prepares the audit routines for compilation. Each audit routine is a Cobol program which includes many tests and supporting procedures indicating the result of the tests. The audit routines collectively contain all of the features of American National Standard Programming Language COBOL-X3.23-1974 (except for the ENTER statement of the Nucleus module and the Communications module in its entirety) as specified in Federal Information Processing Standard (FIPS) 21-1.
GRA

62 COMPUTER SYSTEMS

Includes computer networks.

N77-29844 Purdue Univ., Lafayette, Ind.
A NEW RECURSIVE APPROACH TO THE RELIABILITY ANALYSIS OF LARGE-SCALE NETWORKS Ph.D. Thesis
Carlos Lisboa 1976 454 p
Avail: Univ. Microfilms Order No. 77-7486

The investigation is centered on the topological reliability analysis of physical systems made up of two state components subject to two performance levels: a favorable, a successful, or an operative state and an unfavorable, a failed, or an inoperative state. Two major topics were considered: the terminal pair probabilistic connectivity problem and the global probabilistic connectivity problem. A modest but sincere effort to unify and give perspective to the various results obtained in the literature so far was carried, with the hope of providing a systematic basis for analysis and direction for future research in the area of probabilistic network theory. A new approach was developed to solve the more general problem of finding the probability of the mathematical union or intersection of a collection of events that are members of any finite probability space. Dissert. Abstr.

N77-29845 Florida Univ., Gainesville.
BANYAN NETWORKS FOR PARTITIONING MULTIPROCESSOR SYSTEMS Ph.D. Thesis
Louis Rodney Goke 1976 240 p
Avail: Univ. Microfilms Order No. 77-6869

Techniques are proposed for utilizing banyan networks in large, general purpose, partitionable systems containing numerous microprocessors or other resources. Techniques are also presented for constructing banyan networks in modular form and for controlling them in a rapid and potentially fault-tolerant manner using distributed logic in the networks themselves. Statistical simulation results are presented indicating that banyans have a potential cost-performance advantage over large crossbar-based partitioning networks and that this advantage tends to increase with network size. Graph theory and APL vector operations are used in characterizing theoretical banyan properties. Various subclasses of banyans are defined, providing a taxonomy of network structures and permitting the derivation of additional useful properties.
Dissert. Abstr.

N77-29846# Texas Univ., Austin. Center for Cybernetic Studies.
ENHANCEMENTS OF SPANNING TREE LABELING PROCEDURES FOR NETWORK OPTIMIZATION
Richard Barr, Fred Glover, and Darwin Klingman Dec. 1976 26 p refs
(Contracts N00014-75-C-0616; N00014-75-C-0569)
(AD-A038210; CCS-262) Avail: NTIS HC A03/MF A01 CSCL 12/1

New labeling techniques are provided for accelerating the basis exchange step of specialized linear programming methods for network problems. Computational results are presented which show that these techniques substantially reduce the amount of computation involved in updating operations.
Author (GRA)

N77-29847# Texas Univ., Austin. Center for Cybernetic Studies.
THE NETFORM CONCEPT: A MORE EFFECTIVE MODEL FORM AND SOLUTION PROCEDURE FOR LARGE SCALE NONLINEAR PROBLEMS
Fred Glover (Colorado Univ., Boulder), Darwin Klingman, and Claude McMillan (Colorado Univ., Boulder) Feb. 1977 25 p refs
(Contracts N00014-75-C-0616; N00014-75-C-0569; N00014-76-C-0383; NR Proj. 047-021)
(AD-A038212; CCS-281) Avail: NTIS HC A02/MF A01 CSCL 12/2

This paper presents modeling techniques which are mathematically and symbolically linked to network and augmented network structures. These modeling techniques are called the NETFORM (network formulation) concept or approach. The pictorial aspect of this approach has proven to be extremely valuable in both communicating and refining nonlinear and combinatorial re-

lationships. Additionally, the NETFORM concept often yields a formulation that enables the problem to be solved as a sequence of linear network problems with dramatic gains in efficiency over alternative approaches. Thus we show that the NETFORM concept provides an effective means for modeling, communicating, and solving nonlinear problems. GRA

N77-29848# National Bureau of Standards, Washington, D. C. Inst. for Computer Science and Technology.
COMPUTER SCIENCE AND TECHNOLOGY: THE USE OF PASSWORDS FOR CONTROLLED ACCESS TO COMPUTER RESOURCES Interim Report
Helen M. Wood May 1977 63 p refs
(PB-266323/5; NBS-SP-500-9; LC-77-5558) Avail: NTIS HC A04/MF A01 CSCL 09B

The generation of passwords and their effective application to the problem of controlling access to computer resources are studied. After describing the need for and uses of passwords, password schemes are categorized according to selection technique, lifetime, physical characteristics, and information content. Password protection, both in storage and transmission, is dealt with followed, by brief sections on current implementations and cost considerations. A glossary and an annotated bibliography of all referenced material are included. GRA

N77-29849# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
THE INTERFACE MESSAGE PROCESSOR PROGRAM
Mar. 1977 120 p refs Supersedes AD-A025358
(Contracts DAHC15-69-C-0179; F08606-73-C-0027)
(AD-A040675) Avail: NTIS HC A06/MF A01 CSCL 09/2

The ARPA Network has been in operation for almost eight years and has become an international facility. The network has grown to more than sixty sites spread across the continental United States, plus satellite connections to Hawaii, Norway, and England, and is steadily growing; approximately one hundred independent computer systems of varying manufacture are interconnected. Provision has been made for terminal access to the network from sites which do not enjoy the ownership of an independent computer system. Implementation of the IMPs required the development of a sophisticated computer progam. This program has been previously described in. As stated then, the principal function of the IMP program is the processing of packets, including the following: segmentation of Host messages into packets; receiving, routing, and transmitting store-and-forward packets; retransmitting unacknowledged packets; reassembling packets into messages for transmission into a Host; and generating RFNMs and other control messages. The program also monitors network status, gathers statistics, and performs on-line testing. GRA

63 CYBERNETICS

Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

N77-29850 Illinois Univ., Urbana-Champaign.
STABILITY AND MULTI-MODELS IN MODEL REFERENCE ADAPTIVE SYSTEMS Ph.D. Thesis
Dale Keith Barbour 1976 171 p
Avail: Univ. Microfilms Order No. 77-8929

Several problems related to model reference adaptive systems (MRAS) are investigated. The MRAS finds application both in control system design in an uncertain environment and in parameter identification. The development is based on a parallel MRAS structure whose adaptation design guarantees that the MRAS is hyperstable. A MRAS structure containing multiple reference models is introduced. A relationship is established between the structure and a particular dynamic game, comparing the equilibrium of the MRAS and the dynamic game solution obtained assuming a Nash strategy. The stability properties of the 2-model case are examined, under the assumption that each adaptation subsystem is of the hyperstable design.
Dissert. Abstr.

N77-29851 Michigan Univ., Ann Arbor.
NECESSARY CONDITIONS FOR OPTIMAL CONTROL OF SYSTEMS GOVERENED BY PARTIAL DIFFERENCE EQUATIONS
Daniel Richard Hegg 1976 116 p
Avail: Univ. Microfilms Order No. 77-7933

The basic problem is an optimal control problem in Mayer form with general pointwise state and control constraints for a system of nonlinear first order difference equations in Euclidean space with several independent variables. The structure of the difference equations is motivated by the Dieudonne-Rashevsky form for first order partial differential equations, in which each of the first order partial derivatives of the state vector is expressed explicitly as a nonlinear function of the state and the control. In the basic problem considered, each of the difference equations is a general nonlinear function relating the state vector, the control, and one of the first order partial differences of the state vector; the partial difference expression appears linearly with a coefficient matrix independent of the state and the control.
Dissert. Abstr.

N77-29852 Stanford Univ., Calif.
CONDITIONED LIMIT THEOREMS IN QUEUEING THEORY
Peichuen Kao 1976 71 p
Avail: Univ. Microfilms Order No. 77-7108

Stochastic processes which arise out of a general single server queueing system were studied. The weak convergence of queueing processes, conditioned on an event whose probability was converging to zero, as time becomes large, was examined. Results were extended to a variation of the general single server queueing system, where there were several initial customers instead of only one. This simple generalization enabled the establishment of results for certain multiple channel queueing systems.
Dissert. Abstr.

N77-29853 Stanford Univ., Calif.
SOME STRUCTURED PROBLEMS IN THE OPTIMAL CONTROL OF DIFFUSIONS Ph.D. Thesis
Allison James Taylor 1976 96 p
Avail: Univ. Microfilms Order No. 77-7173

An underlying diffusion process was assumed whose state space is the positive halfline. In the general formulation, a decision maker was given a set A of available actions and selected stationary policy which associated with every state a corresponding action in A. When an action was selected, the decision maker earned rewards at a rate dependent on the state and the action selected, and the state of the system evolves locally as a diffusion process with state and action dependent infinitesimal parameters. Three types of boundary behavior were considered. The controlled process was simply absorbed (and no further rewards were earned) once state zero was hit. In the second formulation, the process jumped immediately to a fixed positive state from the boundary, and a fixed cost was incurred. In the final formulation, the decision maker can choose the size of the jump from the boundary, and the corresponding cost is a function of the jump size.
Dissert. Abstr.

N77-29854 Stanford Univ., Calif.
A THEORY FOR SEMI-MARKOV DECISION PROCESSES WITH UNBOUNDED COSTS, AND ITS APPLICATION TO THE OPTIMAL CONTROL OF QUEUEING SYSTEMS, INCLUDING THE M/G/1 QUEUEING SYSTEM WITH REMOVABLE SERVER Ph.D. Thesis
Peter Orkenyi 1976 181 p
Avail: Univ. Microfilms Order No. 77-7139

The problem is to characterize optimal policies. Three optimality criteria are used, namely, the average cost criterion, the undiscounted cost criterion, and the discounted cost criterion. The analysis is centered about unimprovable policies, i.e., policies which cannot be improved by changing its decision rule for the first decision epoch. An optimal policy must be unimprovable, but the opposite is not necessarily true. Conditions which, together with the unimprovability condition, constitute necessary and sufficient conditions for optimality are presented. Several different approaches are used to obtain different sets of optimality conditions. The application of this theory to the optimal control of queueing systems is explored.
Dissert. Abstr.

N77-29855 Illinois Univ., Urbana-Champaign.
FROG (FORMULATION OF A ROBOT ORGANIZATION THAT GENERALIZES): A HARDWARE EXPERIMENT IN MACHINE COGNITION Ph.D. Thesis
Debasish Bose 1976 101 p
Avail: Univ. Microfilms Order No. 77-8942

A scheme is developed for machine representation of knowledge for artificial cognition of stimuli characterized by multi-parameter feature (sensory input) vector, with a view to achieving (1) adaptive behavior (2) ability to handle new situations and (3) fast response. The scheme proposed includes a learning strategy which organizes the experience with known inputs in various levels of inductive generalization, and a recognition strategy which makes the processing of stimulus for cognition proceed from the most general context towards a more detailed and specific search. The scheme is exemplified by simulating the feeding habits of a small animal in an actual hardware demonstration project called FROG (Formulation of a Robot Organization that Generalizes). FROG is a mini-robot which sustains existence by recognizing sources of potential food supply and hazards.
Dissert. Abstr.

N77-29856# Technische Universitaet, Brunswick (West Germany). Inst. fuer Angewandte Mathematik.
ESTIMATES OF MULTIDIMENSIONAL DENSITIES WITH HERMITIAN POLYNOMIALS AND LINEAR METHODS FOR TREND TRACKING [SCHAETZUNGEN MEHRDIMENSIONALER DICHTEN MIT HERMITESCHEN POLYNOMEN UND LINEARE VERFAHREN ZUR TRENDVERFOLGUNG]
L. Schueler and H. Wolff Bonn DOKZENTBw 1976 74 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(BMVg-FBWT-76-23) Avail: NTIS HC A04/MF A01; DOKZENTBw, Bonn DM 30

A parameter-free method for density estimation of a simple sample was developed using the series technique applicable to pattern and character recognition. The basic relations for the estimates are derived from the Hermitian polynomial system. An ALGOL computer program is described for determining the estimation function. A linear method for trend tracking was investigated. A method for convergency acceleration is described. The method was tested using simulation results. ESA

N77-29857# National Physical Lab., Teddington (England). Div. of Quantum Metrology.
AN ELECTRONIC SERVOCONTROL SYSTEM FOR STABILIZED LASERS AND SIMILAR APPLICATIONS
K. C. Shotton and W. R. C. Rowley Sep. 1976 37 p refs Revised
(NPL-QU-28-Rev) Avail: NTIS HC A03/MF A01

Lasers are often frequency stabilized by means of a feedback control system which detects, and seeks to minimize, the output intensity of the optical cavity. The design of an electronic feedback system used for this purpose at the National Physical Laboratory is discussed, and full circuit diagrams with suggested component layout schemes are given. These circuits include the oscillator, phase shifter, coherent signal filter, phase sensitive detector and double integrator stages, a high voltage output amplifier, suitable for driving piezoelectric transducers supporting the laser mirrors, being described in the appendix. There are also notes on circuit adjustments and on example methods of use for laser or interferometer control. Author (ESA)

N77-29858# European Space Agency, Paris (France).
STRUCTURAL PROPERTIES OF LINEAR DYNAMIC SYSTEMS: APPLICATION TO OPTIMAL CONTROL AND FILTERING
Omer L. Mercier Jul. 1977 53 p refs Transl. into ENGLISH of 'Proprietes Structurelles des Systemes Lineaires Dyn.', ONERA, Paris Report ONERA-NT-1977-4, Mar. 1977 Original report in FRENCH previously announced as N77-25859
(ESA-TT-403; ONERA-NT-1977-4) Avail: NTIS HC A04/MF A01

The major results concerning the modern concepts of controllability, observability, reconstructibility, stability, stabilizability, and detectability of linear dynamic systems are presented. These concepts, developed during the 1960 to 1972 period, are of prime importance for the control of dynamic systems, especially to design feedback controls and to synthesize the filters, state reconstructors, and observers usually associated with these controls. Author (ESA)

N77-29859# Iowa State Univ. of Science and Technology, Ames. Dept. of Mathematics.
ALGEBRAIC TESTS FOR FUNCTIONAL CONTROLLABILITY OF FUNCTIONAL DIFFERENTIAL EQUATION SYSTEMS Interim Report
R. Triggiani Apr. 1977 8 p refs
(Grant AF-AFOSR-3038-76)
(AD-A038937; AFOSR-77-0545TR) Avail: NTIS HC A02/MF A01 CSCL 12/2

Results obtained during this period of research include solving two approximate controllability problems, which were previously open. New treatments were provided for rederiving already known tests for Euclidean controllability. New conditions were derived for spectral controllability (and hence stabilizability) much easier to handle than those previously known. An interesting link was brought to light between point wise degeneracy and the lack of approximate controllability in Hilbert defined approximate controllability and Popov reachability was clarified. Author (GRA)

N77-29860# National Bureau of Standards, Washington, D. C.
WORKSHOP ON STANDARDS FOR IMAGE PATTERN RECOGNITION
John M. Evans, Russell Kirsch, and Roger N. Nagel May 1977 115 p Conf. Held at Gaithersburg, Md., 3-4 Jun. 1976 Sponsored in part by Electronic Industries Association, IEEE, Assoc. for computing machinery, NIH
(PB-266580/0; NBS-SP-500-8; LC-77-4773) Avail: NTIS HC A06/MF A01 CSCL 09B

A two day workshop was held at the National Bureau of Standards in Gaithersburg, Maryland on June 3 and 4, 1976. The workshop considered the issues involved with interchange of images as data in standard formats on magnetic tapes. Specifically, the workshop addressed the following objectives: (1) to define mechanisms for achieving a standard format for magnetic tape interchange; (2) to define requirements for documentation of the recording environment of an image; (3) to recommend mechanisms for selecting and distributing prototype images; (4) to consider the requirements and to explore the prospect for a language to describe image content and structure. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N77-29861 Carnegie-Mellon Univ., Pittsburgh, Pa.
COMPUTATIONAL COMPLEXITY OF ONE-STEP METHODS FOR THE NUMERICAL SOLUTION OF INITIAL VALUE PROBLEMS Ph.D. Thesis
Arthur Gustav Werschulz 1977 85 p
Avail: Univ. Microfilms Order No. 77-7799

Numerically approximating the solution of an ordinary differential equation initial value problem is considered. For any given one step method, the complexity of finding an approximate solution with an insignificant error is evaluated. Given an infinite sequence of one step methods of increasing order, the method and the step size are selected so as to minimize the complexity of finding such an approximation. Dissert. Abstr.

N77-29862 University of South Florida, Tampa.
STUDIES IN BAYESIAN DISCRIMINANT ANALYSIS Ph.D. Thesis
Richard Laurence Westlake Welch 1976 284 p
Avail: Univ. Microfilms Order No. 77-9263

The Bayes discriminant procedure is first investigated from the standpoint of data which is not distributed normally. Monte Carlo samples and actual medical data are used to evaluate how effective the assumption of normality is with regard to the true distribution of the data. The use of a mean square error loss function, instead of the usual 0-1 or unit loss function, is considered next. Attention is particularly paid to the relative

differences between the two loss functions when the normal density function is mistakenly utilized. Multivariate extensions of these topics are presented. Finally, in classical Bayes decision theory, it is assumed that the prior probability of a randomly chosen observation being from any given class is known and specified. This assumption is very likely not to be satisfied in practice; it is reasonable, however, to utilize past information to estimate this quantity. Empirical Bayes Techniques, similar to those derived for reliability theory, are adapted and applied to this problem. Dissert. Abstr.

N77-29863 State Univ. of New York, Stony Brook.
BOUNDARY EQUATIONS FOR THE NUMERICAL SOLUTION OF MIXED HYPERBOLIC PROBLEMS Ph.D. Thesis
Donald Lee Durack 1976 98 p
Avail: Univ. Microfilms Order No. 77-7779

The problem of choosing ad hoc equations near the boundary is considered for the case in which a fourth order accurate, centered difference operator is used in the interior to approximate a mixed problem for a symmetric hyperbolic system with homogeneous, maximal non-positive boundary conditions. Particular attention is payed to energy conserving problems, including the Neumann problem for the wave equation and Maxwell's equations with perfect conductor boundary conditions. Difference equations near the boundary are constructed so that the approximate solutions obey apriori energy estimates similar to those satisfied by exact solutions to the differential equation problem. A set of first order accurate boundary equations which can be used quite generally is derived. Higher order accurate boundary equations are derived for some particular examples by taking advantage of the effect of the boundary conditions from the differential equation problem on the truncation error near the boundary. Computational results indicate that the order of truncation error near the boundary has little effect on the overall accuracy. Dissert. Abstr.

N77-29864 State Univ. of New York, Stony Brook.
SOLUTION OF BORDERED TYPE NONLINEAR EQUATIONS Ph.D. Thesis
Ling Ling Juang 1976 94 p
Avail: Univ. Microfilms Order No. 77-7775

An algorithm for solving a system of nonlinear equations with Bordered type structure matrix is developed, which makes use of the Implicit Function Theorem and the successive substitution method to derive the convergence matrix for the iterative scheme. The convergence matrix requires only a small portion of storage required by the Newton Raphson method, while, the speed of convergence to the root is not reduced. Several techniques of partitioning and tearing the system to the bordered type are discussed. Three computational schemes for the convergence matrix are derived. The first one requires little storage and converges superlinearly, but needs more computations at each iteration than the other two. The second one requires more storage, but less computation for each iteration. The third one requires very little storage and computation for each step, but converges rather slowly. The algorithm and the computational schemes were tested successfully in a mathematical model of human kidney and the results of these tests are given.
Dissert. Abstr.

N77-29865 Notre Dame Univ., Ind.
BLOCKING OF THE SUBGROUP CENTRALIZER ALGEBRA Ph.D. Thesis
Lynn Jay Olson 1977 41 p
Avail: Univ. Microfilms Order No. 77-8548

The block theory of the subgroup centralizer algebra is studied. This algebra is formed by the elements of the groups algebra KG which commute with the subgroup H of G. The main question investigated is how to partition the irreducible characters of K(G:H) into blocks. In particular, various character algorithms designed to determine this blocking are detailed. Dissert. Abstr.

N77-29866 Minnesota Univ., Minneapolis.
CANONICAL REDUCTION OF MECHANICAL SYSTEMS INVARIANT UNDER ABELIAN GROUP ACTIONS WITH AN APPLICATION TO CELESTIAL MECHANICS Ph.D. Thesis
William Joseph Satzer, Jr. 1976 65 p
Avail: Univ. Microfilms Order No. 77-7000

A mechanical system is considered whose energy function is invariant under some conditions group of symmetries. These symmetries are used to reduce the dimension of the phase space of the system. Certain conditions on the group of symmetries pass to the reduced phase space by a canonical change of variables, so the form of the Hamilton-Jacobi equations is preserved. Dissert. Abstr.

N77-29867 Stanford Univ., Calif.
INITIAL BOUNDARY VALUE PROBLEMS FOR INCOMPLETELY PARABOLIC SYSTEMS Ph.D. Thesis
John Charles Strikwerda 1976 111 p
Avail: Univ. Microfilms Order No. 77-7170

Initial boundary value problems for incompletely parabolic systems of partial differential equations are studied. Such systems can be described as a second order Petrovskii parabolic system and a first order hyperbolic system coupled together by terms with first order spatial derivatives. The dependent variables are then of either parabolic or hyperbolic type. Examples are the equations for coupled sound and heat flow and the viscous shallow water equations. The Cauchy problem for incompletely parabolic systems is well-posed and by means of the energy method the existence and uniqueness of the solution are proven. Also considered are imcompletely parabolic systems with smooth coefficients on bounded domain with smooth boundary. It is shown that the initial boundary value problem is well-posed if certain constant coefficient problems on half-space are well-posed. This is carried out using freezing arguments which utilize Garding inequalities for pseudo-differential operators. A theory of pseudo-differential operators that depend on a parameter is developed. Dissert. Abstr.

N77-29868 Stanford Univ., Calif.
INEQUALITIES FOR DISTRIBUTIONS WITH GIVEN MARGINALS Ph.D. Thesis
Andre Han-ting Tchen 1976 77 p
Avail: Univ. Microfilms Order No. 77-7175

For bivariate distributions H with fixed marginals F and G, the notion of stochastic dominance for the cumulative distribution functions H(x,y) is shown to formalize exactly the qualitative notion of concordance. When F and G concentrate their mass on finitely many atoms, say that H' is more concordant than H iff H' can be obtained from H by a finite number of repairings T sub epsilon (x,x',y,y'), where T sub epsilon adds mass epsilon < 0 at the atoms (x,y) and (x',y') while subtracting mass epsilon at (x,y') and (x',y) where $x' < x, y' < y$. Thus large values of X are more often associated with large values of Y under H' than under H. It is proven that A iff the cumulative distribution functions of H and H' satisfy H'(x,y) $<$ or equal to H(x,y) for all x,y.
Dissert. Abstr.

N77-29869 New Mexico Univ., Albuquerque.
ESTIMATION OF HAZARD FUNCTIONS BY SPLINE FUNCTIONS Ph.D. Thesis
Chi-Ming Tang 1976 82 p
Avail: Univ. Microfilms Order No. 77-6573

The empirical cdf from a random sample with size n is transformed to get the sample integrated hazard function. The hazard estimator is the derivative of an interpolatory spline function. If the unknown integrated hazard function H has K continuous derivatives, the rate of convergence for the jth derivative can be obtained. Also, the interpolatory spline and its derivative converge to the unknown H and its derivative h respectively. We represent the spline function in terms of the reproducing kernel functions and are then able to prove asymptotic normality. Two applications, cubic spline and tension spline, are given. The spline under tension can be constructed so that it is a monotone function. This is by virtue of its having a non-negative derivative. Two numerical examples using spline under tension are given. Dissert. Abstr.

N77-29870 Purdue Univ., Lafayette, Ind.
THE RELATIONSHIP BETWEEN EXTERNAL VARIABLES AND INDETERMINATE FACTORS Ph.D. Thesis
James Hubert Steiger 1976 76 p
Avail: Univ. Microfilms Order No. 77-7530

The relationship was explored between indeterminate factors and external variables, i.e., those not included in the original

test battery. This relationship was important for several reasons. First, there was no compelling reason to restrict one's interest to the original test battery, in evaluating factors. If a factor analysis was to discover new random variables which explain a broad behavior domain, then these new variables, once identified, must not only relate meaningfully to the variables in the test battery. Second, the consideration of external variables provided a new perspective for evaluating some previous misconceptions about factor indeterminacy. Third, the relationship between factors and external variables was crucial to the use of factor analysis as a vehicle for making decisions about people. Dissert. Abstr.

N77-29871 Oklahoma State Univ., Stillwater.
ANALYSIS OF BINARY DATA IN DESIGNED EXPERIMENTS Ph.D. Thesis
Arvind Kantilal Shah 1976 136 p
Avail: Univ. Microfilms Order No. 77-5185

Test procedures analogous to the analysis (ANOVA) procedures were developed for the analysis of balanced one-way and two-way classifications with one or more binary observations per cell. Binary analysis of variation statistics (BIAOVA) are proposed to test various hypotheses for these procedures. For the case of the one-way classification with binary responses, the proposed BIANOVA test, B, happens to be uniformly more powerful than the Pearson's chi-square test and the standard F test given by the ANOVA. The B test was generally observed to be liberal. The proposed BIANOVA tests for the factorial arrangements of treatments can be extended to include any number of factors at any number of levels. It is possible to generalize all of the proposed tests to multi-way classifications. Dissert. Abstr.

N77-29872 Colorado State Univ., Fort Collins.
RATIOS AND OUTLIERS IN LINEAR REGRESSION Ph.D. Thesis
David Lee Otis 1976 105 p
Avail: Univ. Microfilms Order No. 77-6805

Approximations are given for the bias and variance of both the ratio and regression estimator when sampling from a finite population. Simulation results are given indicating the accuracy of the approximations. Test procedures are proposed for testing the hypothesis of equality of ratios of two different populations, the procedure depending upon the types of populations being sampled. Simulation results indicating the effectiveness of the test procedures in controlling their size are given. A new test procedure for detecting a single outlier in simple linear regression based on systematic elimination of a single data point from the data set is shown to be equivalent to a previously proposed test procedure based on standardized residuals. Both tests are shown to be generalized likelihood ratio tests. Simulation results of the power of the test indicate very low power when the outlier occurs at an extreme x-value. A new test procedure is given for this situation and simulation results indicate the test may possess very high power. Dissert. Abstr.

N77-29873 Florida State Univ., Tallahassee.
MOMENT INEQUALITIES, MAXIMAL INEQUALITIES AND THEIR APPLICATIONS Ph.D. Thesis
Michael Thomas Longnecker 1976 96 p
Avail: Univ. Microfilms Order No. 77-8601

Moment and maximum inequalities are developed and applied to probability theory and statistics. Dependence statistics of the weak multiplicative type are examined. Several new restrictions of this type are introduced and placed in perspective with various more stringent conditions. Moment inequalities are derived which place upper bounds for sequences which satisfy dependence restrictions of the weak multiplicative type. Maximal inequalities of the moment are then considered as well as probability inequalities for the maximum partial sum. Dissert. Abstr.

N77-29874 Stanford Univ., Calif.
MARKOV MAINTENANCE MODELS WITH REPAIR
Yukio Hatoyama 1976 180 p
Avail: Univ. Microfilms Order No. 77-7098

In each model, a machine is assumed to be operating over time with its condition deteriorating as time goes on. The state of the machine is observed at the beginning of a period. An operating machine can be sent to a repair shop at this time, whereas a failed machine must be repaired. When a machine is being repaired, the number of time periods that it is unavailable is usually assumed to have a geometric distribution. A repaired machine becomes available in its best state. An operating cost is charge while a machine is operating, and material and labor costs are charged when it is being repaired. The objective is to find a policy which minimizes the total expected alpha discounted cost or the long-run average cost. Special emphasis is being placed on finding sufficient conditions to assure that a control limit policy is optimal. Dissert. Abstr.

N77-29875 Texas Technological Univ., Lubbock.
AN ALGEBRAIC TOPOLOGICAL APPROACH TO STABILITY THEORY Ph.D. Thesis
Raymond Anthony Decarlo 1976 44 p
Avail: Univ. Microfilms Order No. 77-8744

Stability theory using frequency domain techniques essentially began with the advent of the Nyquist Criterion. System stability requires only a binary decision on the number of encirclements. Using Homotopy Theory, a branch of Algebraic Topology, new proofs of the classical Nyquist Criterion along with the more recent multivariable results are constructed. These ideas are then generalized to a Nyquist-like test for the stability of multidimensional digital filters. Basically the test is a series of Nyquist tests, each of which is more or less easily implemented on a computer. In particular, a kinship between the distinguished boundary of the polydisk and the classical Nyquist contour is established. A special form of homotopy is also defined. It is this special definition of homotopy that suitably describes the stability of multidimensional digital filters characterized by transfer functions in several complex variables. Dissert. Abstr.

N77-29876 Johns Hopkins Univ., Baltimore, Md.
MANY-BODY DIAGRAMS IN DEGENERATE RAYLEIGH-SCHRODINGER PERTURBATION THEORY
James Jesunathadas 1977 90 p
Avail: Univ. Microfilms Order No. 77-7737

The Rayleigh-Schrodinger perturbation series derived by Silverstone was converted into a many body diagrammatic expansion. The diagrams were a mixture of many electron parts and state parts. There were unlinked diagrams in the expansion, and so a concise method of depicting the overall structural kinds of diagrams that are allowed was developed - the representative diagrams. These permitted the Huby-Brueckner terms to be easily translated into diagrams and made cancellations among classes of diagrams transparent. Various kinds of cancellations in the degenerate case are discussed. A new proof of the linked cluster expansion in the nondegenerate case is a by-product of this investigation. A calculation of the Beryllium isoelectronic series in the format of the Z-dependent theory was done to exemplify the theory. Dissert. Abstr.

N77-29877# Center for Naval Analyses, Arlington, Va.
PHASE SPACE PATH INTEGRALS, WITHOUT LIMITING PROCEDURE
Maurice M. Mizrahi May 1977 41 p refs
(AD-A040107; CNA-Professional-Paper-186) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper defines path integrals in phase space without using a time-division approach followed by a limiting process, thereby generalizing a similar procedure used in configuration space. This is useful since the path integral approach cannot always be formulated in configuration space (e.g., when the Hamiltonian is arbitrary) but can always be formulated in phase space. The most general Gaussian measure, absorbing the quadratic portion of the functional to be integrated, is constructed, and large classes of path integrals are evaluated with respect to it. Applications are given to the perturbation expansion and the semiclassical (WKB) expansion for arbitrary Hamiltonians. Author (GRA)

N77-29878# New York Univ., N. Y. Courant Inst. of Mathematical Sciences.
METHOD OF LINES SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS
J. M. Hyman Oct. 1976 113 p
(Contract EY-76-C-02-3077)
(COO-3077-139) Avail: NTIS HC A06/MF A01

An analysis is given of effective strategies for the so-called method of lines solution of the initial boundary-value problem for partial differential equations of the form u/sub t/ = g(x,t,u,u/sub x/,u/sub xx/,f-/sub x/), where f = f*x,t,u,u/sub x/,u/sub xx/). Also described is a user-oriented FORTRAN subroutine package called MOLID for the numerical solution of equations of this type using the method of lines. ERA

N77-29879# Illinois Univ., Urbana. Dept. of Computer Science.

USER'S VIEW OF SOLVING STIFF ORDINARY DIFFERENTIAL EQUATIONS

L. F. Shampine (Sandia Labs., Alburquerque, N. Mex.) and C. W. Gear Sep. 1976 34 p refs

(Contract EY-76-S-02-2383)

(COO-2383-0036) Avail: NTIS HC A03/MF A01

The numerical solutions of stiff ordinary differential equations are examined by identifying problem areas and basic difficulties. The characteristics shared by these methods are considered in assembling codes. ERA

N77-29880# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.

THE DIFFERENTIAL SYSTEM Bx SUB = Ax AND THE GENERALIZED EIGENVALUE PROBLEM Au = LAMBDA Bu

J. H. Wilkinson Jan. 1977 35 p

(NPL-NAC-73) Avail: NTIS HC A03/MF A01

The mathematical treatment of many practical problems gives rise to systems of linear differential equations with constant coefficients. Any such systems may be expressed in matrix notation in the form Bx sup . equals Ax where A and B are n x n matrices and x a vector of order n. It is shown that the solution of the differential system is intimately connected with the solution of the generalized algebraic eigenvalue problem. If B equals 1 the system becomes x sup . = Ax and is referred as an explicit first order system; in all other cases Bx sup . equals Ax is referred as an implicit system. An attempt is made to present the precise relationship between the algebraic problem and the differential problem in the general case to have a clear understanding of the system. Explicit systems and the Jordan canonical form are presented in order to facilitate the comparison with explicit systems. The implicit systems with non-singular B, singular B and non-singular A, singular A and B are discussed. Numerical examples are given to illustrate the theory. ESA

N77-29881# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.

THE COMPUTATION OF LAGRANGE-MULTIPLIER ESTIMATES FOR CONSTRAINED MINIMIZATION

Philip E. Gill and Walter Murray Mar. 1977 52 p refs Presented at the Symp. on Matrix Methods in Optimization, Argonne Natl. Lab., Jun. 1976

(NPL-NAC-77) Avail: NTIS HC A04/MF A01

General procedures for computing Lagrange-multiplier estimates for both linearly-constrained and nonlinearly-constrained algorithms are described and a method for assessing the validity of these estimates is suggested. These techniques have been incorporated in all the constrained-optimization subroutines produced at the National Physical Laboratory. Special attention has been given to the estimation of near-zero Lagrange multipliers. The techniques described can be extended to the non-linearly constrained case while for algorithms which construct a quadratic sub-problem, any near-zero Lagrange multipliers which occur at that stage can be tackled using the described techniques. ESA

N77-29882# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.

NUMERICALLY STABLE METHODS FOR QUADRATIC PROGRAMMING

Philip E. Gill and Walter Murray Apr. 1977 43 p refs

(NPL-NAC-78) Avail: NTIS HC A03/MF A01

A technique for the positive (matrix G) definite quadratic programming is outlined. Then this method is generalized to give an effective technique for the indefinite quadratic programming case. The algorithms are based on the recurrence of matrix factorizations. Consideration is given to the need for an algorithm for indefinite quadratic programming which is compatible with those for general linearly-constraint optimization. A comparison of two basic iterations for positive-definite and indefinite quadratic programming demonstrates that there is no significant loss of efficiency when solving positive-definite problems with an algorithm designed for indefinite problems. For this reason a single routine is provided in the NPL algorithms library for the solution of both problems. This is useful when the quadratic program is a sub-program of a more generalized optimization method and it is not possible to ascertain initially whether or not G is indefinite. The algorithm is numerically stable and uses linear algebraic techniques which are common to other forms of optimization, leading to numerical software which is modular in the sense that many subroutines are shared by other optimization software. ESA

N77-29883# Illinois Univ., Urbana-Champaign. Dept. of Computer Science.

ERROR ESTIMATION AND INTERATIVE IMPROVEMENT FOR THE NUMERICAL SOLUTION OF OPERATOR EQUATIONS Interim Report

Bengt Lindberg Jul. 1976 96 p refs

(Grant AF-AFOSR-2854-75)

(AD-A038182; UIUCDCS-R-76-820; AFOSR-77-0294TR) Avail: NTIS HC A05/MF A01 CSCL 12/1

A method for estimation of the global discretization error of solutions of operator equations is presented. Further an algorithm for iterative improvement of the approximate solution of such problems is given. The theoretical foudation for the algorithms are given as a number of theorems. Several classes of operator equations are examined and numerical results for both the error estimation algorithm and the algorithm for iterative improvement are given for some classes of ordinary and partial differential equations and integral equations. Author (GRA)

N77-29884# Rome Air Development Center, Griffiss AFB, N.Y.

WALSH TRANSFORM PULSE DETECTION IN HIGH NOISE ENVIRONMENTS

Ronald M. Okupski Mar. 1977 55 p refs

(AF Proj. 4027)

(AD-A038651; RADC-TR-77-62) Avail: NTIS HC A04/MF A01 CSCL 14/2

The Walsh Hadamard Transformation is shown through computer generated graphics to be very useful for detecting rectangularly shaped information carrying pulses that exist in high noise environments. This transformation is used to process the time domain input signal and determine if one or more pulses are present in the noise. A Fast Walsh Transform (FWT) algorithm is used to generate the sequency domain coefficients. It is shown that by low pass filtering of the Walsh Spectrum coefficients, the pulse can be detected since the higher order coefficients contribute only to the noise. A combination of low pass filtering and amplitude thresholding of the Walsh spectrum is shown to provide an optimal signal detection capability.

Author (GRA)

N77-29885# Texas Univ., Austin. Center for Cybernetic Studies.

TRANSFORMS AND APPROXIMATIONS IN COST AND PRODUCTION FUNCTION RELATIONS

A. Charnes, W. W. Cooper (Harvard Univ., Cambridge, Mass.), and A. Schinnar (Pennsylvania Univ.) Jan. 1977 24 p refs Prepared in cooperation with Carnegie-Mellon Univ.

(Contracts N00014-75-C-0616; N00014-76-C-0932; Grant NSF SOC-76-15876; NR Proj. 047-021)

(AD-A038213; CCS-284) Avail: NTIS HC A02/MF A01 CSCL 05/3

Known results in the mathematics of transform theory, e.g., as exhibited in Laplace transforms, are here used as a guide for exploring difficulties in what are sometimes called duality relations between cost and production functions in economic theory. Difficulties in specifying the set of production possibilities and in approximation with translog functions are identified by means of a simple process analysis example. Hazards associated with the possible uses of these ideas on energy studies and like topics are commented on in specific detail. GRA

N77-29886*# Stanford Univ., Calif. Dept. of Computer Science.

ON COMPUTING THE SINGULAR VALUE DECOMPOSITION
Tony Fan C. Chan Aug. 1976 61 p refs
(Contract NCA2-OR-745-520; Grant NSF DCR-75-13497)
(NASA-CR-154278; PB-266381/3; STAN-CS-77-588) Avail: NTIS HC A04/MF A01 CSCL 12A

It is shown that by (1) triangularizing the matrix A by Householder transformations before bidiagonalizing it, and (2) accumulating some left transformations on an n x n array instead of on an m x n array, the resulting algorithm is often more efficient than the Golub-Reinshch algorithm. Two algorithms are computational experiments that were carried out to verify the theoretical comparisons. GRA

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N77-29887 Michigan Univ., Ann Arbor.
STOCHASTIC MODELS FOR BIOCHEMICAL SYSTEMS Ph.D. Thesis
Sandra Jean Hasstedt 1976 88 p
Avail: Univ. Microfilms Order No. 77-7932

The theory of Markov processes was employed to derive the probability functions. It incorporated variation due to randomness of collisions between molecules. Solutions applied to the phase of the reactions in which the probabilities no longer change, at equilibrium (closed) or steady state (open). An application for one of the open system models was considered. This application was the detection of mutations from concentrations of reactants measured in vivo. A stochastic model for reactants in a closed biochemical system at equilibrium is presented. The theory applies to the complete range of biochemical systems from single enzyme reactions to complete pathways. Prior to examining the general system, probability functions were derived for the following example systems: (1) a reaction with a competitive inhibitor (2) a bisubstrate reaction using the ping-pong mechanism, and (3) a series of two monosubstrate reactions. Dissert. Abstr.

N77-29888 Michigan Univ., Ann Arbor.
ASYMPTOTIC DISTRIBUTION AND APPLICATIONS OF THE MAXIMUM LIKELIHOOD ESTIMATOR IN THE INDEPENDENT NOT IDENTICALLY DISTRIBUTED CASE Ph.D. Thesis
Lih-wen Huang 1976 59 p
Avail: Univ. Microfilms Order No. 77-7942

The classical theory of maximum likelihood estimation from independent and identically distributed observations to the independent and not identically distributed cases is examined. Dissert. Abstr.

N77-29889 Minnesota Univ., Minneapolis.
A GENERAL DEFINITION OF CONVOLUTION FOR DISTRIBUTIONS Ph.D. Thesis
Heekyung Kang 1976 75 p
Avail: Univ. Microfilms Order No. 77-7030

The objective of this study is to introduce and develop a unified theory of convolution for distributions. The most important cases where convolutions occur in classical theory are when all but one of the distributions have compact support, and when the distributions are given by measures which have a convolution. A coherent theory, based on the ideas developed is applied to various classical situations (e.g., the Hilbert transform). Dissert. Abstr.

N77-29890 Purdue Univ., Lafayette, Ind.
ON SOME MULTIPLE DECISION PROBLEMS Ph.D. Thesis
Ming-Wei Lu 1976 129 p
Avail: Univ. Microfilms Order No. 77-7488

Some selection and ranking procedures for restricted families of probability distributions are studied. A selection rule is proposed for distributions which are convex-ordered with respect to a specified distribution G. Some properties of this selection rule are derived. The asymptotic relative efficiencies of this rule with respect to other selection rules are evaluated. A selection rule is also proposed and studied for distributions which are s-ordered with respect to G. Some interval estimation problems for the unknown parameters of the k populations are studied. The infimum of the probability that a given confidence interval (based on suitably chosen order statistics) contains at least one good population is obtained. The selection procedures are discussed in terms of majorization and weak majorization. The parameter is partially ordered by means of majorization or weak majorization. A class of procedures R sub h for selecting the best population is defined. Dissert. Abstr.

N77-29891 Minnesota Univ., Minneapolis.
ON SOME ASPECTS OF THE CLASSIFICATION PROBLEM Ph.D. Thesis
Hsien Elsa Lin 1976 117 p
Avail: Univ. Microfilms Order No. 77-6973

Different rules for the problem of classifying one or more unit, to one of several distinct populations on the basis of random training samples are considered and their asymptotic probabilities of misclassification (PMC) are derived. First, the problem of classifying one unit to one of three distinct multivariate normal distributions with a common covariance matrix is considered. The problem of classifying one unit to one of two distinct populations with completely unknown distribution functions is then studied. Rules based on U statistics are suggested and the asymptotic PMC of the rules are obtained together with the rate of convergence as the sizes of the training samples approach infinity. Finally, sequential rules based on U-statistics to control the PMC uniformly and arbitrarily are discussed. The moment generating function is shown to exist. Dissert. Abstr.

N77-29892 Wisconsin Univ., Madison.
THE LARGE SAMPLE BEHAVIOR OF POSTERIOR DISTRIBUTIONS WHEN SAMPLING FROM MULTIPARAMETER EXPONENTIAL FAMILY MODELS, AND ALLIED RESULTS Ph.D. Thesis
Joseph Nathaniel Ladalla 1976 133 p
Avail: Univ. Microfilms Order No. 76-29992

An asymptotic development in powers of n to the - 1/2 power for the posterior distribution when sampling from multiparameter exponential family, is given. The justifiability is established of term by term integration of the asymptotic expansion for the posterior distribution to get a similar expansion for the marginal distribution of any subset of the parameters. Similarly, an asymptotic expansion for the conditional distributions is obtained by formally dividing an expansion for the posterior density by that of the marginal. However, in this case, the conditioning variables are restricted to take values near their maximum likelihood estimators. Next, an asymptotic expansion for posterior risk, determined from a quadratic loss function, is given. The leading term of this risk is the corresponding risk computed under the limiting normal. Expansions for the posterior moments are also given. Using certain regularity conditions a simple method to get better approximations to the true highest posterior density (H.P.D.) regions is presented, particularly for the two parameter case. Dissert. Abstr.

N77-29893 Florida Univ., Gainesville.
TESTS OF SYMMETRY BASED ON THE CRAMER-VON MISES AND WATSON STATISTICS Ph.D. Thesis
David Lawrence Hill 1976 72 p
Avail: Univ. Microfilms Order No. 77-8184

The problem of testing whether a continuous distribution is symmetric about zero is considered. Two classes of statistics obtained by modifying the two-sample Cramer-von Mises statistic are studied. Statistics in these two classes are shown to lead to consistent tests of symmetry and to possess an invariance property. By combining statistics from the two classes, a third class is obtained. Statistics in the third class are shown to lead to consistent tests of symmetry and to possess an additional invariance property. A class of statistics obtained from a modification of the Watson two-sample statistic is defined. Statistics in this fourth class are shown to lead to consistent tests of symmetry and to possess the invariance property possessed by statistics in the first two classes. In addition, one of the statistics in the fourth class is shown to possess both invariance properties, and exact critical values are calculated for

this statistic. The common asymptotic null distribution for statistics in the fourth class is shown to be the asymptotic null distribution of the Cramer-von Mises goodness-of-fit and two-sample statistics. Dissert. Abstr.

N77-29894 Michigan Univ., Ann Arbor.
A DESIGN PROBLEM IN THE BAYESIAN ESTIMATION OF THE TREATMENT EFFECTS IN THE ONE-WAY BALANCED FIXED EFFECTS MODEL Ph.D. Thesis
Edrisa Thallay Bangura 1976 94 p
Avail: Univ. Microfilms Order No. 77-7863

Given the number of treatments, and the prior parameters, it was desirable to know how many replicates are needed for the use of the more probable approximations to E (theta/delta). Some of Hill's approximations to E (theta/data) were derived by a different method, and in addition a new asymptotic approximation to E (theta/data) was attained by Laplace's method for integrals with a large parameter. The Bayes risks for the treatment effect and contrast are derived. Further an inequality for the risk of the treatment contrast, which may be used to determine a suitable number of replicates, given the number of treatments and prior parameters, has been obtained. Dissert. Abstr.

N77-29895 American Univ., Washington, D.C.
RELATIVE STABILITY OF SELECTED CORRELATION AND REGRESSION STATISTICS IN COMPLEX SAMPLING Ph.D. Thesis
James Turner Baird, Jr. 1976 161 p
Avail: Univ. Microfilms Order No. 77-8274

Technique development for estimation of sampling errors in large scale surveys is discussed in relation to statistical theory. Highly complex sample designs require variance estimators based on computer oriented empirical techniques. Objective criteria for the selection of variance estimators, based on complex sample data are reported. Dissert. Abstr.

N77-29896 California Univ., Los Angeles.
ROBUST SOURCE CODING OF FINITE ALPHABET SOURCES VIA COMPOSITION CLASSES Ph.D. Thesis
Donald Ray Martin 1976 93 p
Avail: Univ. Microfilms Order No. 77-7676

A robust coding technique, which universally encodes stationary sources and has properties which are independent of the source characterization is described. Dissert. Abstr.

N77-29897 California Univ., Los Angeles.
ADAPTIVE STOCHASTIC CONTROL FOR LINEAR QUADRATIC SYSTEMS WITH BOTH PLANT AND NOISE PARAMETERS UNCERTAINTIES Ph.D. Thesis
Thomas Kin-sheung Siu 1976 116 p
Avail: Univ. Microfilms Order No. 77-7696

A practical adaptive controller for stochastic linear discrete time quadratic systems, with unknown plant and noise parameters, is developed. An identification scheme was discussed to update all the unknown parameters at each stage and a controller was designed to take precautions against the uncertainties of the system. Dissert. Abstr.

N77-29898# Centre National d'Etudes Spatiales, Toulouse (France).
STATISTICAL ANALYSIS OF PHOTOELECTRONIC FLUCTUATIONS IN SOLID-STATE PHOTODETECTORS. APPLICATION TO PHOTON COUNTING [ANALYSE STATISTIQUE DES FLUCTUATIONS PHOTO-ELECTRONIQUES DANS LES PHOTO-DETECTEURS SOLIDES - APPLICATION AU COMPTAGE DE PHOTONS]
Jean Cazemajou Feb. 1977 43 p refs In FRENCH; ENGLISH summary
(CNES-NT-66) Avail: NTIS HC A03/MF A01

A new method for the statistical analysis of random processes is applied to the study of photoelectron fluctuations in solid-state photodetectors; a general expression of the spectral properties of photonic counting rates, related to the physical properties of the material, is given. Besides classical expressions of frequency behavior and current fluctuations, a formula for the probability of false detection of photonic signals was derived. Author (ESA)

N77-29899# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
FURTHER RESULTS ON THE UNCERTAINTY THRESHOLD PRINCIPLE Interim Report
Richard T. Ku and Michael Athans 10 Mar. 1977 12 p refs Submitted for publication
(Grants AF-AFOSR-3281-77; NSF SOC-76-05837)
(AD-A039011; ESL-P-727; AFOSR-77-0580TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Additional quantitative results are presented for the existence of optimal decision rules and stochastic stability for linear systems with white random parameters with respect to quadratic performance criteria, by examining a specific version of a multivariable optimization problem. Author (GRA)

N77-29900# Cornell Univ., Ithaca, N.Y. School of Operations Research and Industrial Engineering.
A TWO-STAGE MINIMAX PROCEDURE WITH SCREENING FOR SELECTING THE LARGEST NORMAL MEAN
Ajit C. Tamhane and Robert E. Bechhofer Jan. 1977 43 p refs
(Contracts DAAG29-73-C-0008; DAAG29-77-C-000321)
(AD-A040067; TR-323) Avail: NTIS HC A03/MF A01 CSCL 12/1

The problem of selecting the normal population with the largest population mean when the populations have a common known variance is considered. A two-stage procedure is proposed which guarantees the same probability requirement using the indifference-zone approach as does the single-stage procedure of Bechhofer. The two-stage procedure has the highly desirable property that the expected total number of observations required by the procedure is always less than the total number of observations required by the corresponding single-state procedure, regardless of the configuration of the population means. The saving is expected total number of observations can be substantial, particularly when the configuration of the population means is favorable to the experimenter. The saving is accomplished by screening out non-contending populations in the first stage, and concentrating sampling only on contending populations in the second stage. The two-stage procedure can be regarded as a composite one which uses a screening subset-type approach in the first stage, and an indifference-zone approach applied to all populations retained in the selected subset in the second stage. Constants to implement the procedure for various k and p^* are provided, as are calculations giving the saving in expected total sample size if the two-stage procedure is used in place of the corresponding single-stage procedure. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N77-29901 Wisconsin Univ., Madison.
AN APPROACH TO THE SOLUTION OF INTIALLY INFEASIBLE ALLOCATION PROBLEMS Ph.D. Thesis
Ronald Martin Saidikowski 1976 312 p
Avail: Univ. Microfilms Order No. 77-3423

The minimum cost allocation of resources is studied with an emphasis on systems which have insufficient raw materials or conflicting restraints. A method has been developed to deal with such infeasible linear programming problems. The constraints which impede the solution are identified and then are modified in an attempt to produce a new problem which can be solved. Dissert. Abstr.

N77-29902 Purdue Univ., Lafayette, Ind.
FRAMES AND COORDINATES IN GENERAL RELATIVITY AND THEIR RELATION TO MECHANICAL AND ELECTROMAGNETIC PHENOMENA Ph.D. Thesis
John George Papastavridis 1976 165 p
Avail: Univ. Microfilms Order No. 77-7510

The constitutive theory, which Lianis developed based on these concepts, is applied to the study of two classes of problems involving the interaction of continuous matter with mechanical and electromagnetic fields. A new principle of objectivity,

appropriate for relativistic constitutive equations is proposed. This principle is the combination of the concepts of proper observer and rigid frame of reference. A specific frame is introduced, and its properties are studied. It is proved that such a frame is appropriate for the derivation of objective constitutive equations. The concept of rotation in the context of general relativity is examined. This concept, combined with the appropriate mechanical work concept, is used to show how the Euclidean group of transformations, serving as an invariance requirement associated with the classical principle of objectivity, can lead to erroneous conclusions. Dissert. Abstr.

N77-29903 California Univ., San Diego.
POSTPONED LINEAR APPROXIMATIONS IN STOCHASTIC MULTIPERIOD PROGRAMMING Ph.D. Thesis
Richard Arthur Ashley 1976 67 p
Avail: Univ. Microfilms Order No. 77-8716

A monotonically convergent sequence of approximate solutions for the stochastic multiperiod programming problem, cast into the form of a production-inventory programming problem, is proposed. The kth member of the sequence corresponds to assuming that the firm uses a linear policy from period k on. It is shown that, so long as all costs are expressible as polynomial functions, the first two or three orders of approximation can be readily calculated for a wide variety of models via a multivariate numerical minimization. For example, explicit formulas for the minimand are developed for firms with costs of adjustment, production lags, and sales generated (and forecast) by an autoregressive moving average process. The algorithm is also extended to be the multiproduct firm, to the firm with probabilistic cost functions, and to the firm with some monoply power.
Dissert. Abstr.

N77-29904 Illinois Univ., Urbana-Champaign.
UNCONSTRAINED NONLINEAR DISCRETE SEARCH Ph.D. Thesis
Atthakorn Glankwahmdee 1976 223 p
Avail: Univ. Microfilms Order No. 77-9001

Several all purpose search methods for unconstrained nonlinear discrete variable optimization problems are developed. Some are based on modifications of highly effective continuous variable search techniques, while others are based on relatively simpler concepts. These procedures are classed gradient-free or gradient-based, depending upon whether or not gradient approximation is required to generate the search directions. In all methods, in order to search only over a set of discrete points, the concept of integer search direction and the subsequential search procedure are introduced. Other developments include regeneration/acceleration procedures for gradient-based methods and a second level acceleration procedure applicable to all new methods. Dissert. Abstr.

N77-29905*# Aerophysics Research Corp., Bellevue, Wash.
HEURISTIC APPROACH TO THE DEVELOPMENT OF RATINGS AND TACTICS APPLICABLE TO THE ONE-ON-ONE AERIAL COMBAT (DOGFIGHT) ENCOUNTER
D. S. Hague Jul. 1977 32 p refs
(Contract NAS2-9223)
(NASA-CR-152000) Avail: NTIS HC A03/MF A01 CSCL 12B

Computer simulations of the one-on-one aerial combat encounter are generated under the control of specified guidance laws. Given an initial state, the vehicle and atmospheric characteristics, and the guidance laws, the aerial combat encounter is simulated by forward integration of the two vehicles' motions. The development of a combat guidance law which converts positional advantage into an improved firing opportunity is reported. A combination of lag, line of sight, and lead pursuit steering paths are followed in the guidance law. The law is based on steering error, target angle-off and the relative velocities. It readily is automated either as an onboard aid to manned aircraft pilots or as a combat guidance law for unmanned vehicles. Author

N77-29906# George Washington Univ., Washington, D.C.
SPARES PROVISIONING FOR REPAIRABLE ITEMS: CYCLIC QUEUES IN LIGHT TRAFFIC
Donald Gross and John F. Ince 21 Mar. 1977 47 p refs
(Contract N00014-75-C-0729; NR Proj. 347-020)
(AD-A040136; Serial-T-346) Avail: NTIS HC A03/MF A01 CSCL 12/1

The classic machine repair problem is extended and modeled as a cyclic queue for the purpose of determining the number of spares and repair channels for a population of items subject to stochastic failure. In this system the operating units, removal of failed units, transportation to repair depot, and the repair itself are treated as four multi-server stations, each with exponential holding times. An exact model is developed from the literature on networks and cyclic queues and compared with a series approximation. Under a constraint requiring a high availability of spares which insures 'light traffic queues', the approximate model is found to be very accurate and computationally more efficient. Author (GRA)

N77-29907# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
BIBLIOGRAPHY ON VOLTERRA SERIES HERMITE FUNCTIONAL EXPANSIONS AND RELATED SUBJECTS
J. F. Barrett Mar. 1977 28 p refs
(TH-77-E-71; ISBN-90-6144-071-8) Avail: NTIS HC A03/MF A01

Publications from about 1940 to the end of 1976 on systems analysis applications of functional series of Volterra and Hermite types are listed. A few papers on closely related topics are also included. Mathematically related work not directly applying to systems analysis has, in general, been excluded. Author (ESA)

N77-29908# Technology Service Corp., Santa Monica, Calif.
TOPICS IN THE ANALYSIS AND OPTIMIZATION OF COMPLEX SYSTEMS Final Report
William S. Meisel and Leo Breiman 28 Feb. 1977 63 p refs
(Contract F44620-76-C-0069; AF Proj. 2304)
(AD-A038209; AFOSR-77-0376TR) Avail: NTIS HC A04/MF A01 CSCL 12/2

This one-year contract was in essence a continuation of a previous five year effort. The purpose was to discover more effective methods of analyzing high dimensional data sets. The motivation was the conviction that classical methods were often inappropriate and led to misleading results. A technical paper entitled 'Variable Kernel Estimates of Multivariate Densities and Their Calibration' was accepted for publication in Technometrics. The problem treated was to estimate some unknown probability density in m variables based on n independent samples from that distribution. The solution is an extension of a method proposed by Parzen. Additional work was concerned with completing two other papers that were almost finished during the previous year in the areas of goodness-of-fit and classification methods. Author (GRA)

N77-29909# Stanford Univ., Calif. Information Systems Lab.
NEW RESULTS IN 2-D SYSTEMS THEORY, 2-D STATE-SPACE MODELS: REALIZATION AND THE NOTIONS OF CONTROLLABILITY, OBSERVABILITY AND MINIMALITY Interim Report
B. Levy, S. Y. Kung, and M. Morf 1976 10 p refs
(Contracts F44620-69-C-0101; N00014-67-A-0112-0044; Grant NSF ENG-75-18962)
(AD-A038391; AFOSR-77-0370TR) Avail: NTIS HC A02/MF A01 CSCL 12/2

A short comparison between the different state-space models is presented. We discuss proper definitions of state, controllability and observability and their relation to minimality 2-D systems. We also present new circuit realizations and 2-D digital filter hardware implementations of 2-D transfer functions, as well as a 2-D generalization of Levinson's algorithms. Author (GRA)

N77-29910# California Univ., Berkeley. Operations Research Center.
THE ANALYTIC METHODS OF OPERATIONS RESEARCH
William S. Jewell Jan. 1977 84 p refs
(Contract N00014-76-C-0134)
(AD-A036434; ORC-77-6) Avail: NTIS HC A05/MF A01 CSCL 12/2

Originally, the techniques used by operational research teams were borrowed from other scientific fields. However, the scope of problems addressed by this new discipline soon led to the

development of special analytic methods, including such now familiar terms as linear programming, game theory, dynamic programming, queueing theory, and so forth. The author discusses some of these analytic methods. GRA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N77-29911 Stanford Univ., Calif.
BANACH SPACES WHICH SATISFY LINEAR IDENTITIES Ph.D. Thesis
Bruce Arie Reznick 1976 101 p
Avail: Univ. Microfilms Order No. 77-7155

The proof that any Banach space which satisfies the parallelogram law must be a Hilbert space is discussed, as well as weaker identities whose satisfaction in a Banach space ensures the existence of an inner product. A natural generation of the parallelogram law is demonstrated. Let Q sub r denote a parallelopiped on r generators in a Banach space X. An s-diagonal can be defined in the standard way. Let h(s,t) denote the sum of the t-th powers of the norms of all s-diagonals in Q sub r. If t=2n and n is strictly less than r, then the alternating sum (in s) of h(s,t) vanishes provided that X is in P sub 2 n. For r=2 and n=1, the alternating sum is the familiar parallelogram law, and one obtains the theorem of Jordan and von Neumann. Dissert. Abstr.

N77-29912 Stanford Univ., Calif.
SCATTERING THEORY AND LINEAR LEAST SQUARES ESTIMATION Ph.D. Thesis
Benjamin Friedlander 1976 244 p
Avail: Univ. Microfilms Order No. 77-7088

A unifying framework developed for (continuous and discrete) estimation results based on state-space models gives physical interpretation to the various quantities involved in terms of light intensity in a scattering medium with internal sources. Other features are an interpretation of the decomposition into measurement-update and time-update as a simple factorization of the scattering matrix and new insights into the Chandrasekhar and the related Levinson- and Cholesky-equations. A way of classifying matrices by a measure of their distance from a Toeplitz matrix is introduced (through the notion of the 'displacement rank' of a matrix). Inversion formulas and an efficient computational algorithm were developed to provide an extension of previously known inversion formulas for toeplitz matrices. Dissert. Abstr.

N77-29913 Purdue Univ., Lafayette, Ind.
SOME ASPECTS OF VOLTERRA SERIES Ph.D. Thesis
Edmund Michael Geyer 1976 198 p
Avail: Univ. Microfilms Order No. 77-7452

Some aspects of the Volterra series model for nonlinear systems are investigated. The material is divided into four parts: mathematical properties of Volterra series, the solution of abstract nonlinear equations by abstract Volterra series, concrete applications of the abstract theory, and measurement of Volterra kernels. Dissert. Abstr.

N77-29914*# Old Dominion Systems, Inc., Gaithersburg, Md.
THE INCOMPLETE INVERSE AND ITS APPLICATIONS TO THE LINEAR LEAST SQUARES PROBLEM
Georg E. Morduch Washington Aug. 1977 84 p refs
(Contract NAS5-23587)
(NASA-CR-2892) Avail: NTIS HC A05/MF A01 CSCL 12A

A modified matrix product is explained, and it is shown that this product defiles a group whose inverse is called the incomplete inverse. It was proven that the incomplete inverse of an augmented normal matrix includes all the quantities associated with the least squares solution. An answer is provided to the problem that occurs when the data residuals are too large and when insufficient data to justify augmenting the model are available. Author

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N77-29915*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PROCEEDINGS OF THE 7TH ANNUAL PRECISE TIME AND TIME INTERVAL (PTTI) APPLICATIONS AND PLANNING MEETING
4 Dec. 1975 713 p refs Meeting held in Greenbelt, Md., 2-4 Dec. 1975
(NASA-TM-74829; AD-A040774; X-814-76-45) Avail: NTIS HC A99/MF A01 CSCL 14/2

The Proceedings contain the papers presented at the Seventh Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting and the edited record of the discussion period following each paper. This meeting provided a forum to promote more effective, efficient, economical and skillful applications of PTTI technology to the many problem areas to which PTTI offers solutions. Specifically the purpose of the meeting is to: disseminate, coordinate, and exchange practical information associated with precise time and frequency; acquaint systems engineers, technicians and managers with precise time and frequency technology and its applications; and review present and future requirements for PTTI. GRA

N77-29916# Centre National de la Recherche Scientifique, Marseilles (France). Lab. d'Astronomie Spatiale.
CALIBRATION PROCEDURE FOR FAUST EXPERIMENTS [PROCEDURE DE CALIBRATION DES EXPERIENCES FAUST]
M. Saisse, G. Claeysen, and A. M. Tournade 17 Feb. 1976 48 p In FRENCH
(LAS-76-OPT-PHY-FST-06) Avail: NTIS HC A05/MF A01

Methods for the calibration of the Faust series experiments FU216 and FU217 are presented. They are concerned with the trace of characteristics for the 1600 A wavelength with or without the prism, the trace of bandpass (including the prism dispersion effect), sensitivity evolution, and study of the spectrum of the Cerenkov source used as standard emitting in the bandpass range. ESA

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N77-29917 Oklahoma State Univ., Stillwater.
ACOUSTICAL SIGNATURE ANALYSIS OF HIGH PRESSURE FLUID PUMPING PHENOMENA Ph.D. Thesis
George Earl Maroney 1976 299 p
Avail: Univ. Microfilms Order No. 77-5138

This study examines the propsition that acoustical signature analysis provides a noninstrusive diagnostic technique for high pressure fluid power systems. The study, which focuses on the acoustical behavior of high pressure gear pumps, considers the theoretical sensitivity of gear pump noise levels to fourteen variables, and experimentally examines the sensitivity of pump noise levels to time (including wear), inlet pressure, outlet pressure, speed, temperature, air/liquid volume ratio, and contamination levels. The theoretical considerations include an acoustical model for pump noise generation, a noise wear index relating acoustical signature variations to component performance degradation, and the definition and discussion of three categories of cavitation. Dissert. Abstr.

N77-29918*# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.
EFFECTS OF INTERIOR AIRCRAFT NOISE ON SPEECH INTELLIGIBILITY AND ANNOYANCE Final Report
Karl S. Pearsons and Ricarda L. Bennett Aug. 1977 67 p refs
(Contract NAS1-14463)

(NASA-CR-145203) Avail: NTIS HC A04/MF A01 CSCL 20A

Recordings of the aircraft ambiance from ten different types of aircraft were used in conjunction with four distinct speech interference tests as stimuli to determine the effects of interior aircraft background levels and speech intelligibility on perceived annoyance in 36 subjects. Both speech intelligibility and background level significantly affected judged annoyance. However, the interaction between the two variables showed that above an 85 db background level the speech intelligibility results had a minimal effect on annoyance ratings. Below this level, people rated the background as less annoying if there was adequate speech intelligibility. Author

N77-29919# Federal Aviation Administration, Washington, D.C.

HELICOPTER NOISE MEASUREMENTS DATA REPORT. VOLUME 1: HELICOPTER MODELS: HUGHES 300-C, HUGHES 500-C, BELL 47-G, BELL 206-L

Harold C. True and Richard M. Letty Apr. 1977 386 p 2 Vol.

(AD-A040561; FAA-RD-77-57-Vol-1) Avail: NTIS HC A17/MF A01 CSCL 01/3

The purpose of this test program was to provide a data base for a possible helicopter noise certification rule. Only the measured data is presented. The eight helicopters tested during this Helicopter Noise Test Program constituted a wide range of gross weights and included participation from several helicopter manufacturers. The helicopter models used in this test program were the Hughes 300C, Hughes 500C, Bell 47-G, Bell 206-L, Bell 212 (UH-1N), Sikorsky S-61 (SH-3A), Sikorsky S-64 Skycrane (CH-54B), and Boeing Vertol Chinook CH-47C. The test procedure for each helicopter consisted of obtaining noise data during hover, level flyover, and approach conditions. The data consist of time histories, 1/3-octave band spectra, EPNL, PNL, dBA, dBD and OASPL noise levels. Author

N77-29920# Federal Aviation Administration, Washington, D. C.

HELICOPTER NOISE MEASUREMENTS DATA REPORT. VOLUME 2: HELICOPTER MODELS: BELL 212 (UH-1N), SIKORSKY S-61 (SH-3A), SIKORSKY S-64 SKYCRANE (CH-54B), BOEING VERTOL CHINOOK (CH-47C)

Harold C. True and Richard M. Letty Apr. 1977 418 p 2 Vol.

(AD-A040562; FAA-RD-77-57-Vol-2) Avail: NTIS HC A18/MF A01 CSCL 01/3

For abstract, see N77-29919.

N77-29921*# Tufts Univ., Medford, Mass.

INVESTIGATION OF THE EFFECTS OF A MOVING ACOUSTIC MEDIUM ON JET NOISE MEASUREMENTS

John E. Cole, III and Douglas W. Palmer Dec. 1976 91 p refs

(Contract NCA2-OR785-601)

(NASA-CR-152038) Avail: NTIS HC A05/MF A01 CSCL 20A

Noise from an unheated sonic jet in the presence of an external flow is measured in a free-jet wind tunnel using microphones located both inside and outside the flow. Comparison of the data is made with results of similar studies. The results are also compared with theoretical predictions of the source strength for jet noise in the presence of flow and of the effects of sound propagation through a shear layer. Author

N77-29922# Stanford Univ., Calif. Edward L. Ginzton Lab.

MICROWAVE ACOUSTIC AND BULK DEVICE TECHNIQUE STUDIES Semiannual Report, 1 Nov. 1975 - 30 Apr. 1976

Marvin Chodorow and H. J. Shaw Griffiss AFB, N. Y. RADC Feb. 1977 21 p refs

(Contract F30602-74-C-0038; AF Proj. 5573)

(AD-A040047; GL-2602; RADC-TR-77-80; SAR-5) Avail: NTIS HC A02/MF A01 CSCL 09/5

Work on a monolithic parametric convolver using guided surface acoustic waves in a piezoelectric zinc oxide film on a silicon substrate, and related topics, has been submitted for publication. Construction has been completed on the electronics package and microcomputer control system for an 8-bit A/D converter with 2 microsec conversion time, using a SAW delay line as a linear signal processing element, and the system is ready for initial testing. High conversion efficiency has been observed in barium titanate capacitor laminates used as electrostrictive transducers. These elements, and also poled polyvinylidene fluoride films, are being investigated as nonlinear signal processing elements for use in focused two-dimensional phased arrays. Author (GRA)

N77-29923# Institut Franco-Allemand de Recherches, St. Louis (France).

EXPERIMENTAL STUDY OF LATERAL WIND EFFECT ON FREE JET NOISE [ETUDE EXPERIMENTALE DE L'EFFET D'UN VENT LATERAL SUR LE BRUIT EMIS PAR UN JET LIBRE]

M. Schaffar, P. G. Sava, and J. J. Brunner 23 Jun. 1976 37 p refs In FRENCH

(ISL-R-121/76) Avail: NTIS HC A03/MF A01

The lateral wind simulates the transversal component of the relative wind due to the flight speed, whereby the engine's angle of attack is taken into account. For a realistic velocity ratio, it was found that a strong increase takes place in the noise generated, especially at low frequencies (Strouhal number below 0.5). ESA

N77-29924# Army Materials and Mechanics Research Center, Watertown, Mass.

A REPORT GUIDE TO ULTRASONIC TESTING LITERATURE, VOLUME 7 Final Report

Walter R. Klappert and Charles P. Merhib Nov. 1976 124 p

(AD-A040059; AMMRC-MS-76-5-Vol-7) Avail: NTIS HC A06/MF A01 CSCL 13/8

This report guide covers a portion of the abstracts on ultrasonic testing included in the holdings of the Nondestructive Testing Information Analysis Center. Author (GRA)

N77-29925# Environmental Protection Agency, Dallas, Tex. Hazardous Materials Control Div.

ENVIRONMENTAL NOISE ASSESSMENT, CITY OF GRAND PRAIRIE, TEXAS

George J. Putnicki, Charles S. Riddel, and Hal Watson, Jr. [1977] 97 p Sponsored in part by Texas State Dept. of Health

(PB-266322/7) Avail: NTIS HC A05/MF A01 CSCL 13B

Relatively inexpensive environmental noise assessment of the metropolitan area of Grand Prairie, Texas was made available using the Type-2 sound level meter. Readings were made every 10 seconds and recorded manually on data sheets. A separate data sheet was used for each hour in order to observe the changes in noise levels at various times of day at eight locations. Environmental noise exposure in one portion of the city appears to present a possible risk of permanent hearing damage, and another portion of the city experiences noise exposure high enough to be unsuitable for residential development. GRA

N77-29926# Army Construction Engineering Research Lab., Champaign, Ill.

ANALYSIS OF ENVIRONMENTAL NOISE MONITORS Final Report

P. D. Schomer and A. J. Auerbuch Apr. 1977 27 p

(AD-A040005; CERL-TR-N-21) Avail: NTIS HC A03/MF A01 CSCL 20/1

This report establishes criteria and performance guidelines desirable in environmental noise monitors that are achievable through state-of-the-art technology. To assess this technology, the performances of 10 available units were evaluated based on the following points: (1) Data reduction methods and analytic results; (2) Dynamic range; (3) Impulse response; (4) Environmental considerations (temperature extremes and wind); (5) Shock resistance; (6) Ease of operation; and (7) Likelihood of errors in operation. Favorable and unfavorable features discovered during the investigation of these units are discussed, as well as desirable features found to be absent in all of the units. Based on the study and the conclusions, the operating characteristics of an ideal unit are recommended. GRA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N77-29927 Stanford Univ., Calif.
NON-LINEAR INTERACTIONS OF RELATIVISTIC ELECTRONS AND RADIATION IN MATTER: A NEW TYPE OF ELECTRON PHOTON SCATTERING Ph.D. Thesis
Jaime Sergio Ramos-Salas 1976 60 p
Avail: Univ. Microfilms Order No. 77-7151

The possibility of obtaining laser action from the interaction of relativistic electrons with radiation was examined. In a quantum mechanical model, the second order interaction of a free electron with a radiation field involves a two photon radiative transition of the electron from an initial state to a final state. The transition rates for emission and absorption of two photons were calculated and also the rate equation for the population of any of the photons. A long medium and a short medium were considered and it was found that the gain constants of each case are different. In the short medium, conservation of momentum is not preserved resulting in a spread of the photon wavevectors. Dissert. Abstr.

N77-29928 California Inst. of Tech., Pasadena.
THEORY OF RADIATION LESS TRANSITIONS, LIGHT SCATTERING FLUORESCENCE Ph.D. Thesis
Jacqueline O. Berg 1977 198 p
Avail: Univ. Microfilms Order No. 77-7389

In the first part, a purely electronic mechanism by which approximately 20 eV excitations in condensed nonmetallic phases relax to lower energy states is described. The mechanism utilizes an energy fission process whereby an ionic or excitonic state splits into two lower energy states, at least one being of the Frenkel exciton variety. These relaxation processes should be important in the prechemical stage in the radiation chemistry of condensed phases. The mechanism explains not only the known rapidity of such processes but also suggests an explanation for the proportionation of the chemistry between ionic and electronically excited states. In the second part, Green's functions are used to discuss the time and frequency dependence of light scattering and fluorescence from model systems. Dissert. Abstr.

N77-29929 Florida Univ., Gainesville.
ELECTRONIC AND DYNAMICAL ASPECTS OF DIATOMIC SYSTEMS Ph.D. Thesis
John Curtis Bellum 1976 234 p
Avail: Univ. Microfilms Order No. 79-8143

Diatomic systems are considered from the points of view of their electronic structure and the dynamics of motion of the heavy particles (nuclei) upon collision. The electronic and nuclear motions are treated formally by expressing the Schrodinger equation for the nuclei and electrons in independent variables in the body-fixed, center of mass of the nuclei, frame, and then introducing an expansion in terms of a complete set of electronic states at each internuclear separation. Born-Oppenheimer and Coulomb couplings between the electronic and nuclear motions are pointed out and discussed. Atom-atom interaction potentials and electronic structure are investigated using the multiple scattering calculational scheme with the so-called (alpha) approximation to electronic exchange. The atom pairs, He-He, He-Ar and Ar-Ar are studied, and results are presented for ground and excited state configurations. Dissert. Abstr.

N77-29930 Johns Hopkins Univ., Baltimore, Md.
A NEW APPROACH TO STATISTICAL MODEL OF ATOMS Ph.D. Thesis
Wen-Ping Wang 1977 192 p
Avail: Univ. Microfilms Order No. 77-8283

The Original Thomas-Fermi model of atoms, its theoretical foundation and extensions are discussed. A new approach to the statistical model is developed and several modified statistical models are obtained. Some of these modified multi-region models give densities which are comparable with the corresponding Hartree-Fock densities. A definition for the electronegativity for statistical models is suggested as being electronegativity = negative quantity of chemical potential. Several modified three-region model calculations are reported on second and third row atoms. Dissert. Abstr.

N77-29931# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
BEHAVIOR OF VIBRATIONALLY EXCITED ETHYLENE, CARBONYLSULFIDEAND ACETONITRILE MOLECULES IN THE PRESENCE OF ATOMS [UNTERSUCHUNGEN ZUM VERHALTEN SCHWINGUNGSANGEREGTER AETHYLENE, CARBONYLSULFID- UND ACETONITRILMOLEKUELE IN GEGENWART VON ATOMEN]
M. Kneba, H. G. Wagner, and J. Wolfrum Oct. 1976 39 p refs In GERMAN
(MPIS-23/1976) Avail: NTIS HC A03/MF A01; Max-Planck-Inst. fuer Stroemungsforsch., Goettingen, West Ger. DM 8.55

Experiments are described for determining the reaction behavior of vibrationally excited multi-atomic molecules (C2H4, DCS, CH3CN) in the presence of free atoms. A tunable TEA CO2 laser was used for selective excitation of the molecules. The role of reactive and energy transfer processes was determined by time resolved optical observation of the vibrationally excited particles, and of the atom- and product concentrations. ESA

N77-29932# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
MEASUREMENTS OF NONREACTIVE AND REACTIVE SCATTERING CROSS SECTIONS FOR THE SYSTEMS D+HX AND H+DX (X=Cl,Br, J) Ph.D. Thesis - Goettingen Univ., West Ger. [MESSUNGEN NICHTREAKTIVER UND REAKTIVER STREUQUERSCHNITTE FUER DIE SYSTEME D+HX UND H+DX (X=Cl, Br, J)]
Wolfgang Bauer Dec. 1976 110 p refs In GERMAN
(MPIS-33/1976) Avail: NTIS HC A06/MF A01: Max-Planck-Inst. fuer Stroemungsforsch., Goettingen. West Ger. DM 18.75

The measurement of integral differential scattering cross sections was carried out for scattering systems D + HX and H + DX (X = Cl, Br, J), using a 2600 K hot D and H atomic beam. A velocity selection of the atomic beam was applied for part of the measurements. The temperature of the HX and DX scattering beam was 300 K. Light particles (in less than 3) were detected using a universal detector. LJ (12, 6) potential parameters were determined for the radial parts of the H-HCl and H-HBr potential surfaces. Reactive angular distributions were measured with unselected D and H beam. Reactive H-angular distributions were detected for the exchange reactions D + HX yields H + DX. ESA

N77-29933# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
SCATTERING EXPERIMENTS OF THE VIBRATIONAL EXCITATION OF CO2 AND N2O WITH 7Li(+) IONS AT 8 TO 3 eV ENERGY AND RAINBOW SCATTERING OF 7Li(+) BY He, Ar, Kr AND Xe Ph.D. Thesis - Goettingen Univ., West Ger. [STREUEXPERIMENT DER SCHWINGUNGSANREGUNG VON CO2 UND N2O MIT 7Li(+)-IONEN BEI 8 BIS 3 eV ENERGIE UND REGENBOGENSTREUUNG VON 7Li(+) AN He, Ar, Kr UND Xe]
Ulrich Ross Jan. 1977 164 p refs In GERMAN
(MPIS-2/1977) Avail: NTIS HC A08/MF A01; Max-Planck-Inst. fuer Stroemungsforsch., Goettingen, West Ger. DM 26.10

The vibrational excitation of CO2 and N2O by collisions with Li(+) ions was investigated in a molecular beam experiment. Bending and stretching vibrations were separately examined. Time of flight measurements were carried out for three collision energies: 6.9 eV, 4.7 eV, and 2.8 eV. Calculations of differential scattering cross sections of Li(+) scattering by rare gases He, Ar, Kr, and Xe are also reported. ESA

N77-29934# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
LUMINESCENCE FOR CHARGE EXCHANGE OF ATOM-IONS WITH N2 AND CO MOLECULES IN THE ENERGY RANGE 2 TO 1000 eV Ph.D. Thesis - Bonn Univ. [LUMINESZENZ BEIM LADUNGSAUSTAUSCH VON ATOM-IONEN MIT N2 UND CO MOLEKUELEN IM ENERGIEBEREICH VON 2 BIS 1000 eV]
Jochen Simonis Jan. 1977 156 p refs In GERMAN Sponsored in part by Deut. Forschungsgemeinschaft

(MPIS-3/1977) Avail: NTIS HC A08/MF A01; Max-Planck-Inst. fuer Stroemungsforsch., Goettingen, West Ger. DM 25.80

Electronically excited states of the isoelectronic molecules N2 and CO are formed by charge exchange with several projectile ions. The vibrational occupation and excitation cross sections of these states were determined from the emission spectra. The occupations deviated strongly from the Franck-Condon distribution in the energy range investigated (2 to 1000 eV). Generally, a similar velocity dependence is found for all projectile ions (He(+), Ne(+), Ar(+), C(+), N(+), O(+), H(+), H2(+), H3(+)) above 50 eV. Measurement of the excitation cross sections showed a correlation with the deviation from the Franck-Condon distribution. This was more evident for smaller cross sections. ESA

N77-29935# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
STATISTICAL DYNAMICS OF THE VIBRATION-ROTATION EXCITATION: Li(+)+H2 AT 0.6 eV Ph.D. Thesis - Goettingen Univ., West Ger. [STATISTISCHE DYNAMIK DER VIBRATIONS-ROTATIONS-ANREGUNG: Li(+)+H2 BEI 0.6 eV]
Gerd-Dieter Barg Jan. 1977 209 p refs In GERMAN
(MPIS-4/1977) Avail: NTIS HC A10/MF A01; Max-Planck-Inst. fuer Stroemungsforsch., Goettingen, West Ger. DM 33

A practical method was developed for dynamic analysis of three-dimensional molecular scattering systems and applied to the inelasticity-conditioned effects in Li(+)+H2-ground state. The dynamics were approached from a quasi-classical viewpoint in a formulation based on the Liouville equation. The stationary and time dependent solutions (phase space-probability densities) of the Liouville equation were calculated and interpreted in order to prepare for computerization of the scattering phenomenon. The excitation process was investigated using information theory. Entropy and surprisal were determined as time functions of the rotation distribution. A relationship was shown to exist between dynamic approach and the problem of inelastic potential inversion for a special vibration-rotation transition. ESA

N77-29936# Washington Univ., Seattle. Dept. of Chemistry.
ON THE USE OF EXACT VIBRATIONAL STATE COUNTING METHODS IN RRKM RATE CALCULATIONS
Stephen E. Stein (West Va. Univ., Morgantown) and B. S. Rabinovitch 15 Apr. 1977 18 p refs
(Contract N00014-75-C-0690)
(AD-A039779; NR-092-549-TR04) Avail: NTIS HC A02/MF A01 CSCL 07/4

The use of direct counts of molecular energy level degeneracies, p(E), at internal energy, E, in RRKM unimolecular reaction rate calculations is clarified. Highly accurate densities of states for use in practical rate calculations can be obtained by utilizing an energy level grain size of 1-5/cm and by suitable averaging of P(E) over small energy intervals. An easily programmed algorithm for rounding energy levels to multiples of this grain size is given and applied to sum and density calculations.
Author (GRA)

N77-29937# Harry Diamond Labs., Adelphi, Md.
RESPONSE OF LWIR HgCdTe PHOTOCONDUCTIVE DETECTORS TO IONIZING RADIATION
Stewart Share Dec. 1976 54 p refs
(DA Proj. 8X3-63304-D-215)
(AD-A040397; HDL-TR-1768) Avail: NTIS HC A04/MF A01 CSCL 17/5

The effect of ionizing radiation on 0.09-eV bandgap long wave-length infrared HgCdTe photoconductive detectors at 77 K has been investigated. The results of pulsed gamma, gamma-counting, and gamma-induced noise experiments indicate that the average value of the electron-hole pair creation energy, epsilon rho of Hg 0.8 Cd 0.2 Te is 0.36 plus or minus 0.07 eV. Analysis of gamma-counting and gamma-induced noise experiments indicate that the majority of the gamma events originate from Compton interactions in the surrounding material--for example, glass dewar external to the detector. Initial decay characteristics of the detector response following a prompt gamma pulse appear to depend on the detector material, proceeding either through a bimolecular or a Shockley-Read recombination process. At longer times following the pulse, trap-limited processes become operative in which the fractional level of decay eventually reaches the same value for all the material-preparation techniques evaluated in this work. This applies to detectors in which the surface was left untreated, or was passivated. A detector with the surface treated with a ZnS antireflection coating, however, exhibited an enhanced long time decay response at the largest gamma doses. GRA

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N77-29938 Ohio Univ., Athens.
EXACT CALCULATION OF MATRIX ELEMENTS OF RELATIVISTIC ELECTRONS IN A COULCOMB FIELD Ph.D. Thesis
Krishan Kumar Sud 1976 116 p
Avail: Univ. Microfilms Order No. 77-3499

The purpose was to examine the mathematical difficulties associated with the distorted wave method used for analysis of electron scattering from the atomic nucleus. Due to the long-ranged nature of the electromagnetic interaction, the electron wave functions outside the nuclear radius could not be replaced by plane waves, but rather are solutions to the Dirac equation containing the static Coulomb potential. AS a result of this, radial matrix elements have contributions from the full range of the radial coordinate. The Dirac-Coulomb radial functions obeyed coupled first order differential equations. These equations were expressed as a 2 x 2 first order differential matrix equation.
Dissert. Abstr.

74 OPTICS

Includes light phenomena.

N77-29939 Catholic Univ. of America, Washington, D. C.
A COMPARISON OF LIGHT SCATTERING WITH INFRARED ABSORPTION IN LIQUIDS Ph.D. Thesis
Robert A. Stuckart 1976 161 p
Avail: Univ. Microfilms Order No. 77-2733

The comparison of the spectra obtained from depolarized light scattering and infrared absorption, two well known probes of molecular motion was explored. Light scattering measurements were made in liquid N2, O2, CO, CH4, CF4 for comparison with available IR spectra. Ne, Ar, Kr, and Xe light scattering spectra were compared as a function of density, from dilute gas to solid. Spectra taken in different systems and temperatures were also compared. The spectra were analyzed in terms of a two component induction mechanism, a long range DID and short range mechanism. Dissert. Abstr.

N77-29940 California Inst. of Tech., Pasadena.
THE INVARIANT IMBEDDING SOLUTION FOR ELECTROMAGNETIC WAVE PROPAGATION IN PERIODIC, ALMOST HOMOGENEOUS, AND ALMOST PERIODIC MEDIA Ph.D. Thesis
Gary Bedrosian 1977 134 p
Avail: Univ. Microfilms Order No. 77-7388

The introduction of a complex number, Y, which is simply the reflection coefficient rotated by a fixed phase angle allows the computation of the propagation constant for any periodic medium once the reflection and transmission properties for one cell are known, without any further complications such as matrix equations. The trajectory of the parameter, Y, also provides graphical representation of the properties of a periodic medium. The concepts derived for general periodic media are applied to the class of media whose reflection coefficients remain small. In particular, a small reflection approximation leads to the result that for any medium which is almost homogeneous, there will be one special frequency, for each structure constant in the cosine expansion of the index of refraction, for which the reflection gets large. Dissert. Abstr.

N77-29941 Arizona Univ., Tucson.
LIGHT-SCATTERING CHARACTERISTICS OF OPTICAL SURFACES Ph.D. Thesis
James Elmer Harvey 1976 175 p
Avail: Univ. Microfilms Order No. 77-7332

An investigation of the relationship between surface microstructure and radiant energy scattering was conducted. Light scattering from optical surfaces is treated as a diffraction process in which the pupil function has random phase variations in addition to any existing amplitude variations. A new theory of surface scatter phenomena was formulated by utilizing the same Fourier techniques that have proven so successful in the area of image formation. An analytical expression was obtained for a surface transfer function which relates the surface micro-roughness to the scattered distribution of radiation from that surface.
Dissert. Abstr.

N77-29942 Michigan Univ., Ann Arbor.
ELECTRO-OPTIC MODULATION IN LiNbO3 RIDGE TYPE INTEGRATED OPTICAL WAVEGUIDES Ph.D. Thesis
Thomas Alan Eppes 1976 112 p
Avail: Univ. Microfilms Order No. 77-7907

An analytical basis for evaluating electro-optic modulators and predicting their performance as phase modulators is proposed. In particular, the wave-guide geometry chosen is a ridge type with a rectangular cross-section. The central core consists of LiNbO3 which is melted and re-crystalized on LiTaO3. Air forms the upper boundary with the LiNbO3 while metal clad walls are assumed for the sides. The two metals used in the analysis are gold and aluminum. Approximate mode solutions for the optical boundary value problem are developed and the results used to explore several specific designs. Primary emphasis is placed on predicting speed, physical size, required drive power, insertion loss, and required drive voltage. Comparisons to available experimental data are made. Dissert. Abstr.

N77-29943 Purdue Univ., Lafayette, Ind.
IMAGE RESTORATION AND ENHANCEMENT Ph.D. Thesis
Durga Prasad Panda 1976 192 p
Avail: Univ. Microfilms Order No. 77-7508

Problems related to linear image restoration for human visual systems were considered. Two image models are proposed, a statistical model based on the first- and second-order statistics of image that is used in recursive Bayesian image restoration and an edge-informatic model based on the edge contents of image that is used in image edge enhancement. It is shown that the causal estimator to smooth observation noise is not Bayesian; however, there exists a semi-causal, i.e., causal in one spatial direction and non-causal in the other, form of recursive estimator that is Bayesian. It is further shown that the Bayesian restoration of a general shift variant or shift variant or shift invariant linearly distorted image is also recursive. An edge sharpness criterion is introduced to measure certain qualitative effects of edges. A spatial domain algorithm is proposed to improve the sharpness measure of edges in linearly restored image. Dissert. Abstr.

N77-29944 Michigan Univ., Ann Arbor.
INTERFEROMETRICALLY FORMED MULTICHANNEL PLANAR OPTICAL WAVEGUIDES
Geoffrey Chi-Leung Kung 1976 164 p
Avail: Univ. Microfilms Order No. 77-7961

The objectives and accomplishments are: (1) to demonstrate the equivalence of thick phase gratings and multichannel planar optical waveguides and that such multichannel waveguides can be formed by interferometric means; (2) to develop a simple analysis for a general class of multichannel planar optical waveguides; and (3) to investigate the capability of such structures as basic elements of some kind of optical processing devices. Maxwell's equations approach to the analysis of multichannel planar waveguides is summarized. Both the cases of discretely bounded and nondiscretely bounded waveguides are considered. Dissert. Abstr.

N77-29945# National Bureau of Standards, Washington, D. C.
VISUAL RANGE: CONCEPTS, INSTRUMENTAL DETERMINATION, AND AVIATION APPLICATIONS Final Report
C. A. Douglas and R. L. Booker Mar. 1977 356 p refs
(Contract DOT-FA72WAI-267)
(AD-A041098; NBS-Mono-159; FAA-RD-77-8) Avail: NTIS HC A16/MF A01 CSCL 17/8

Principles, procedures, and instruments used in the measurement of visual range were reviewed. Fundamental concepts of the visual range of objects and lights were discussed and operation of the several classes of atmospheric attenuation meters were reported. The course of development of the transmissometer, its validation and application to aviation operations was stated. An error analysis was made of the effects of instrument errors and of differences in observer thresholds on visibility measurements. A chronological review of the development and application of the runway visual range concept is included together with a discussion of cloud height measurements. Author

N77-29946*# Ball State Univ., Muncie, Ind. Dept. of Physics and Astronomy.
SOLAR CONCENTRATION BY CURVED-BASE FRESNEL LENSES
Ronald M. Cosby Aug. 1977 68 p refs
(NCA8-00127)
(NASA-CR-2890; M-229) Avail: NTIS HC A04/MF A01 CSCL 20F

The solar concentration performance of idealized curved base line focusing Fresnel lenses is analyzed. A simple optical model was introduced to study the effects of base curvature and lens f-number. Thin lens ray tracing and the laws of reflection and refraction are used to develop expression for lens transmittance and image plane intensity profiles. The intensity distribution over the solar spectrum, lens dispersion effects, and absorption by the lens material are included in the analysis. Model capabilities include assessment of lens performance in the presence of small transverse tracking errors and the sensitivity of solar image characteristics to focusing. Author

N77-29947# Centre National de la Recherche Scientifique, Marseilles (France). Lab. d'Astronomie Spatiale.
MULTIDIELECTRIC STACKING TESTS OF PbF2 AND MgF2 [A PROPOS D'ESSAIS D'EMPILEMENTS MULTIDIELECTRIQUES PbF2 - MgF2]
M. Blanc 4 Aug. 1975 29 p refs In FRENCH
(LAS-OPT-75-15) Avail: NTIS HC A03/MF A01

Tests were carried out on multidielectric stacks of PbF2 - MgF2 thin films with a view to applying these in an ultraviolet camera for stellar spectral analysis. Selective mirrors for the near ultraviolet were realized using these coatings, and tested. Aging tests proved to be not entirely satisfactory. Interference filters were also realized and tested for Mg II beam detection (2802 angstrom) for use in a balloon. A blocking was noted, however, for visible light, possibly due to the MgF2. It is concluded that such filters with predetermined characteristics cannot be realized based on PbF2 and MgF2. ESA

N77-29948# Siemens A.G., Munich (West Germany).
OPTICAL COMMUNICATION BY GUIDED WAVES Final Report
Franz Auracher, Peter Baues, Siegfried Geckeler, Herbert Goebel, Ralf Kersten, Wolfgang Kruehler, Hans-Friedrich Mahlein, Peter Moeckel, Hans Pink, Ralf Plaettner et al Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1976 460 p refs In GERMAN; ENGLISH summary
(Contracts BMFT-NT-243; BMFT-NT-563)
(BMFT-FB-T-76-70) Avail: NTIS HC A20/MF A01; ZLDI, Munich DM 96.60

Results are presented of research in optical waveguide communication technology. Topics dealt with are glass fibers, the application of GaAs emitters, optically pumped miniature lasers, electro-optic waveguide modulators, components for an optical repeater (laser amplifier, filters, branching devices), and a comparison of different systems concepts. The following results were obtained: GaAs laser diodes can be directly modulated by the current up to 1 Gbit/s. Epitaxial YAG:Nd (3+) lasers and NdP5O14 miniature lasers with mirror coatings allow cw operation. An electro-optic phase modulator exhibited the smallest characteristic quantity (0.26 mW/MHz) among the waveguide modulators under investigation. GaAs laser amplifiers amplify light signals by 10 - 20 db. Branching networks were achieved both

for monomode and multimode systems using planar optics.
Author (ESA)

N77-29949# National Physical Lab., Teddington (England). Div. of Quantum Metrology.
UV PHOTOELECTRIC SPECTRA FROM SOME MICROWAVE LAMPS SUITABLE FOR CALIBRATING LOW AND MEDIUM RESOLUTION SPECTROSCOPIC INSTRUMENTS BETWEEN 180 nm AND 600 nm
G. H. C. Freeman and I. Freeman Apr. 1977 27 p refs
(NPL-QU-35) Avail: NTIS HC A03/MF A01

All the observed spectral lines of reasonable intensity from a series of commercial sealed-off spectroscopic lamps are listed. Impurity lines as well as those of the element are included in order to prevent confusion in the identification of observed lines. The spectrograms of He, Ne, A, Kr, Xe, Cd, Hg, I, S, H, Cu, and Ge are reproduced as a quick guide to the usefulness of the spectra. Author (ESA)

N77-29950# Cambridge Consultants Ltd. (England).
STUDY OF A SPACECRAFT OPTICAL SIGNAL DISTRIBUTION SYSTEM TO IDENTIFY CRITICAL OPTICAL COMPONENTS Final Report
M. J. Brookfield, J. A. Dawson, and I. Williamson Jan. 1977 322 p refs
(Contract ESTEC-2445/75-AK)
(CCL-C1058; ESA-CR(P)-936) Avail: NTIS HC A14/MF A01

A state-of-the-art review of fiber optic data transmission applied to spacecraft data distribution is presented. Performance of the various components was assessed within the framework of a hypothetical system, the baseline A typical onboard data distribution is described and possible application of integral optics to data distribution reviewed. A specific fiber optics receiver design to indicate electronics requirements is described. The effects of space environmental radiation on the performance of the system was also assessed. An experimental model is described and the related component development is recommended. ESA

N77-29951# Air Force Weapons Lab., Kirtland AFB, N.Mex.
STREAM: A THREE-DIMENSIONAL MONTE CARLO RAY TRACING CODE IN CYLINDRICAL GEOMETRY Final Report
John A. Justice Feb. 1977 25 p
(AD-A038555; AFWL-TR-76-206) Avail: NTIS HC A02/MF A01 CSCL 20/6

This report is a user's guide for STREAM, a code used to theoretically model light transmission through complex, cylindrically symmetric SHIVA-type chamber geometries. Code access at the Air Force Weapons Laboratory (AFWL) and program INPUT are described in detail. Sample output is provided.
Author (GRA)

N77-29952# Naval Electronics Lab. Center, San Diego, Calif.
A-7 AIRBORNE LIGHT OPTICAL FIBER TECHNOLOGY (ALOFT) DEMONSTRATION PROJECT Final Report, Mar. 1974 - Jan. 1977
R. D. Harder, R. A. Greenwell, and G. H. Holma 3 Feb. 1977 48 p refs
(AD-A038455; NELC/TR-2024) Avail: NTIS HC A03/MF A01 CSCL 20/6

A the A-7 ALOFT project successfully demonstrated a fiber-optic signal transmission system can accurately transmit data in the demanding environment of a military aircraft. Included is a summary of the most significant test results, the conclusions reached from the economic analysis, and the compilation of reliability and maintainability data. Author (GRA)

N77-29953# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Advanced Sensors Directorate.
MODELING, ANALYSIS AND SIMULATION OF TARGETS AND BACKGROUNDS FOR INFRARED SEEKERS
Gene E. Gowins and H. Tracy Jackson Apr. 1977 84 p refs (DA Proj. 1W3-62303-A-214)
(AD-A040839; DRDMI-TE-77-7) Avail: NTIS HC A05/MF A01 CSCL 17/5

This report is the first of an anticipated series of progress reports on target/background modeling related to the US Army Missile Research and Development Command's Ground Target Signature Program. This report contains a mathematical model of the data collection system and a generic class of seekers, plus general purpose digital computer models capable of analyzing raw thermal imagery of target-clutter data. The computer program methodology and algorithm flow require the AGA Thermovision information in a discrete input format. Furthermore, the computer programs output results in a three dimensional plot of infrared intensity as a function of aspect angle for every object in each Thermovision data frame. A two-dimensional matrix is generated to represent infrared intensity as a function of position for 10,000 data points on each Thermovision picture. A computer generated interactive graphics plot of objects grouped by intensity produces a histogram distribution for each Thermovision data frame. Such a histogram may be used to assess the feasibility of automatic target cueing technology in detecting and recognizing tactical targets in forward looking infrared imagery.
Author (GRA)

N77-29954# Magnavox Government and Indus. Electronics Co., Fort Wayne, Ind. Electro-Optical Systems
DETECTOR TEST BED Final Report
19 Apr. 1977 15 p
(AD-A040214; EOSR-158) Avail: NTIS HC A02/MF A01 CSCL 17/5

A detector test bed has been designed, fabricated and tested. Some portions of an early model of the HHTV (AN/PAS-7) were incorporated into the design. The goal of the design was to obtain a test bed for the evaluation of thermoelectrically cooled 3 to 5 micrometers PbSeTe photovoltaic detectors. Optics, scanner and some electronics were used from the GFE HHV. All other electrical and mechanical features were designed and developed on the program. In the absence of fully developed detectors, the preamplifiers were designed to interface with a PV detector whose parameters and characteristics were based upon theoretical values. The system is designed to furnish a non-interlaced parallel scan for detector arrays up to 48 elements and element sizes representative of the state of the art. Space was kept available in the opto-mechanical design to allow incorporation of a 2:1 interlace capability at a later date. A forced air cooling concept was furnished to handle the expected cooler power input to the detector (typically 25 watts). A water cooled detector mount was also designed but not fabricated. Test points for individual channels and other special system features will be discussed in the body of this report. Preamplifiers could be supplied to furnish a broader test bed potential, namely, to allow testing of 3 to 5 micron TE cooled HgCdTe P.C. detectors. GRA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N77-29955 Texas Univ., Austin.
THEORETICAL INVESTIGATION OF TOROIDAL FAST WAVE MODES AT TWICE THE ION CYCLOTRON FREQUENCY Ph.D. Thesis
Young Suck Kwon 1976 146 p
Avail: Univ. Microfilms Order No. 77-3935

The technique for calculating the excitation coefficient for a half-turn loop antenna in cylindrical and toroidal geometries filled with anisotropic, dissipative medium is presented. Mode orthogonality relations in a cavity are first developed for a dissipative medium and used to calculate the excitation coefficient in a toroidal cavity partially filled with plasma. With aid of the excitation coefficient, the antenna impedance and wall losses are also calculated in both a cylindrical wave-guide and a toroidal cavity. Appropriate electromagnetic boundary conditions are derived assuming the presence of surface current at the plasma-vacuum boundary. Toroidal effects on fast wave damping are described by means of averaging the plasma dispersion function over the plasma cross section. A toroidal cavity with multiple antennas is also considered as one way of dealing with mode resolvability problems for fusion plasmas. Dissert. Abstr.

N77-29956 Princeton Univ., N. J.
POSSIBILITIES OF LASING IN EXTENDED TWO-DIMENSIONAL MAGNETOPLASMADYNAMIC ARCS Ph.D. Thesis
Gautam Shankar Dutt 1977 143 p
Avail: Univ. Microfilms Order No. 77-7359

A two dimensional discharge apparatus suitable for the study of lasing processes was designed so that lines of sight would pass through regions of uniform properties, provide an optical path length long enough for small gains/losses per unit length to be detected, and establish a range of operating conditions, in terms of the arc current and the flow rate of argon, within which a laterally uniform, guasi-steady discharge could be sustained with low ablation. Lasing was sought in the 4300 A-5300 A spectral range using a resonant optical cavity. No lasing was detected, either in the discharge or in the expanding region for a wide range of operating conditions in argon. In the discharge region, the absence of lasing is ascribable to the extensive trapping of resonant radiation. Dissert. Abstr.

N77-29957 Florida Univ., Gainesville.
KINETIC AND EXPERIMENTAL STUDY OF ARGON AND ARGON-NITROGEN MIXTURES EXCITED BY FISSION FRAGMENTS Ph.D. Thesis
John Franklin Davis, III 1976 148 p
Avail: Univ. Microfilms Order No. 77-8162

Optical emission from argon and argon-nitrogen mixtures excited by fission fragments are studied to better understand the fission fragment energy deposition into the gas. A model of the energy flow in the gas is developed and compared with the experimental results. Computer solutions of the excited state populations densities are obtained for a number of cases upon varying the nitrogen concentration, pressure, and energy deposition form. The model solutions are within a factor of ten of the measured populations (within experimental error) and adequately predict the relative change in magnitude of the measured populations versus nitrogen concentration. Dissert. Abstr.

N77-29958 Michigan Univ., Ann Arbor.
STIMULATED BRILLOUIN SCATTERING IN MAGNETIZED PLASMAS Ph.D. Thesis
Donald James Kenney 1976 107 p
Avail: Univ. Microfilms Order No. 77-7954

The dispersion relation for magnetohydrodynamic instability in stimulated Brillouin scattering in magnetized plasmas is put in the form of the canonical equation for three wave parametric interaction, in order to introduce the damping rates of the stimulated waves. The general dispersion relation is solved for the excitation of forward propagating high frequency Alfven waves, intermediate frequency ion acoustic waves, and backward propagating electromagnetic waves. From the dispersion relation the expressions for the threshold of the instability and its growth rate are derived. Convective saturation o, ne instability due to wave vector mismatch in finite and inhomogeneous plasmas is considered. The results for the growth rates and thresholds of stimulated Brillouin scattering are shown in the form of a set of curves for plasmas having parameters typical of laser plasma interaction experiments. Dissert. Abstr.

N77-29959 Princeton Univ., N. J.
TIME INTEGRATION OF THE IDEAL MHD EQUATIONS IN 2D TOKAMAK GEOMETRY Ph.D. Thesis
Stephen Charles Jardin 1977 291 p
Avail: Univ. Microfilms Order No. 77-7362

MHD equations admit to wave solutions at each of three wave velocities: the fast wave, the transverse wave, and the slow wave. The effects of geometry and of Tokamak ordering cause these wave velocities each to be proportional to a different power of the inverse aspect ratio, which is the Tokamak small parameter. A grouping of linearized normal modes correspond to each of these wave velocities. Interest lies in computing Tokamak stability phenomena which occurs on the intermediate time scale associated with the transverse wave. Standard numerical methods developed for solving fluid equations are unsatisfactory for the investigation of this phenomena, primarily because of the highly anisotropic wave propagation and because of the difficulty in integrating a hyperbolic system of equations over a time scalê associated with other than the fastest characteristic. Dissert. Abstr.

N77-29960 Michigan Univ., Ann Arbor.
INTENSE CO2 LASER INTERACTIONS WITH A DENSE HELIUM Z-PINCH PLASMA Ph.D. Thesis
Duncan Gregory Steel 1976 196 p
Avail: Univ. Microfilms Order No. 77-8043

The interaction of an intense pulse of electromagnetic radiation with a dense, fully ionized plasma was experimentally investigated and compared to different theoretical models. The radiation source was a transverse excited atmospheric pressure CO2 laser. The maximum laser output was 17 J in a 40 ns pulse at a wavelength, lambda = 10.6 microns. This output was focused into the plasma by an f/6.3 copper mirror system using a Newtonian configuration. The maximum focal spot intensity was above 10 to the 11th power W/sq cm. The plasma source was a novel Z-pinch designed and constructed for this experiment. For the above plasma parameters, the laser intensity was well above the thresholds for many predicted instabilities. Furthermore, the predicted growth rates for these instabilities was far shorter than the laser pulse width. Dissert. Abstr.

N77-29961 California Univ., San Diego.
SIDEBAND DISPERSION Ph.D. Thesis
Thomas Peter Starke 1976 209 p
Avail: Univ. Microfilms Order No. 77-8730

The behavior of sideband waves propagating in a plasma dominated by a large amplitude wave was studied. The time averaged velocity distribution was measured, and the dispersion of sideband waves was also measured. Without the large wave present, small waves propagated according to linear dispersion theory. With the large wave present, a beam-like perturbation was observed in the time-averaged velocity distribution and small sideband waves were measured to propagate according to a beam plasma type dispersion. This beam plasma dispersion had three branches: a fast beam branch, a slow beam branch, and the plasma branch. The fast beam branch interrupts the plasma branch and side bands were observed to be unstable on the plasma branch near this interruption. The existence of beam branches allowed more than one wave to propagate lightly damped at many frequencies. Dissert. Abstr.

N77-29962 California Univ., Los Angeles.
PLASMA CONFINEMENT BY SURFACE MAGNETIC FIELDS Ph.D. Thesis
Thomas Karel Samec 1976 188 p
Avail: Univ. Microfilms Order No. 77-7683

Plasma confinement magnet multidipole line cusp configurations were studied. Analytic closed form expressions for the confining magnetic fields are given which agree well with experimental field measurements. Particle escape rates were calculated for a number of possible electric and magnetic field profiles, using appropriate functional forms for the particle distribution functions. A detailed analysis of particle orbits, including a careful consideration of adiabatic invariance for particles which come from regions of low magnetic field, confirms the validity of the assumptions used in calculating particle escape rates. The structures found for low beta charge neutral sheaths show that only sheaths with width larger than an ion cyclotron radius can be stable. Dissert. Abstr.

N77-29963 Princeton Univ., N. J.
RADIAL BOUNDARY LAYERS IN DIFFUSING TOROIDAL EQUILIBRIA Ph.D. Thesis
Mordecai David Rosen 1977 198 p
Avail: Univ. Microfilms Order No. 77-7366

A toroidal equilibrium was stuided, with plasma flow, that is decaying by classical (Pfirsch-Schluter) diffusion. The model equations used are one-fluid, isothermal, low beta, MHD equations, in which a model magnetic field was assumed. There were eight equations for the eight unknowns: mass flow (3) current (3) mass density and electric potential. The equations were the mass continuity, charge conservation, the force law (3), and an Ohm's Law (3) with resistivity. By first investigating straight cylindrical geometry, a condition near the plasma boundary was found implying very steep dénsity gradients. This result was obtained

by solving the diffusion equation with a similarity solution for the density. Dissert. Abstr.

N77-29964 Cornell Univ., New York.
THEORY AND SIMULATION OF LANGMUIR SOLITONS Ph.D. Thesis
Nino Rodrigues Pereira 1976 343 p
Avail: Univ. Microfilms Order No. 77-8371

These solitons consist of bunches of electrostatic energy, coupled to a self-consistent density cavity in the background plasma. A recent theory of strong turbulence in plasma's, by Kingsep, Rudakov and Sudan, (1973) used solitons as basic elements. Langmuir solitons were described by model equations due to Zakharov. In some respects these equations were similar to a class of exactly solvable nonlinear partial differential equations. One of the differences was scaling invariance, which does not exist in Zakharov's model. Consequences of this scaling invariance of exactly solvable nonlinear partial differential equations were studied. Langmuir solitons were simulated in one dimensional particle simulations, and compared with numerical solutions of the model equations. Dissert. Abstr.

N77-29965 Minnesota Univ., Minneapolis.
AN INVESTIGATION OF THE TIME DEPENDENCE OF CERTAIN ION SPECIES AND EXCITED STATES PRESENT IN NITROGEN-RARE GAS AFTERGLOWS Ph.D. Thesis
Clarence Joseph Tracy 1976 103 p
Avail: Univ. Microfilms Order No. 77-7012

Studies were made of the time behavior of the ions and certain excited states found in the afterglow period of discharges in helium-nitrogen, neon-nitrogen, and krypton-nitrogen gas mixtures. The emphasis was placed on determining what reactions occur therein. The combination of several experimental techniques, including optical emission and absorption spectroscopy to monitor excited states and quadrupole mass spectroscopy to sample the ion density, has proved to be of great value in unravelling the mixture of processes within the plasma. Both stationary and flowing afterglow systems were used, each having its own particular advantages. In the helium-nitrogen afterglow, ion density studies were partly successful in resolving some of the large discrepancies in published rate constants for the reactions occurring in such mixtures. Dissert. Abstr.

N77-29966 Illinois Univ., Urbana-Champaign.
X-RAY EMISSION FROM THE INTEREACTION OF A MACROSCOPIC PARTICLE WITH A DENSE PLASMA FOCUS Ph.D. Thesis
Kam Fook Yeung 1976 140 p
Avail: Univ. Microfilms Order No. 77-9245

A method is described for enhancing X-ray radiation by using a macroscopic particle to interact with a plasma focus. Assumptions made in predicting the relative amount of X-ray emission increase from the plasma particle interaction were: the particle essentially has the same physical dimensions throughout the lifetime of the focus because of hydrodynamic pressure compressing any ablated neutral cloud on the particle; and the electrons were thermalized to assume a Maxwellian distribution. The percentage of X-ray enhancement expected was calculated for various particle materials and sizes. A deep plasma focus device was designed and built with a current high enough to produce a plasma focus in a pressure range between 0.5 torr to 2 torr. The electron temperature of the focus is estimated to be 1.15 + or - 0.3 keV by measuring the X-ray emissions through beryllium foils of different thicknesses. This value is in good agreement with that of other focus experiments. Dissert. Abstr.

N77-29967# Oak Ridge National Lab., Tenn. Fusion Energy Div.
AN IMPURITY BEAM-TRAPPING INSTABILITY IN TOKAMAKS
J. T. Hogan and H. C. Howe Dec. 1976 27 p refs
(Contract W-7405-eng-26)
(ORNL-TM-5361) Avail: NTIS HC A03/MF A01

The sensitivity of neutron energy production to the trapping of impurities by injected neutral beams is considered. The beam trapping process is affected by inherent low-Z contamination of the tritium plasma, by the species composition of the neutral beam, and by the entrance angle of the beam. The sensitivities of the process are compared to these variables and to the variation with wall material. Use of a low-Z, low-sputtering material can retard a posible beam trapping instability. Author

N77-29968# Princeton Univ., N. J. Plasma Physics Lab.
OBSERVATION OF PARAMETRIC INSTABILITIES IN LOWER HYBRID RADIO FREQUENCY HEATING OF TOKAMAKS
M. Porkolab, S. Bernabei, W. M. Hooke, R. W. Motley, and T. Nagashima Dec. 1976 11 p refs
(Contract E(11-1)-3073)
(PPPL-1311) Avail: NTIS HC A02/MF A01

During lower hybrid radio frequency heating of the Princeton ATC Tokamak, parametric instabilities are exited, and the ion heating correlates with the presence of the parametric spectra. A theoretical interpretation of the parametric instabilities is presented. ERA

N77-29969# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.
ELECTRON DENSITY MEASUREMENTS IN THE PLASMA FOCUS [ELEKTRONENDICHTEMESSUNGEN AM PLASMAFOKUS]
B. Rueckle 1976 87 p refs In GERMAN
(IPF-76-1) Avail: NTIS HC A05/MF A01

Electron densities were measured in the focus of a coaxial cylindrical plasma accelerator, where plasma compression takes place. A measure for compression is the plasma density defined by the electron density for fully ionized plasmas. The method used for density measurement is based on refraction of a light beam through the axisymmetric plasma, a simple relation existing between maximum electron density and maximum deflection angle of the light beam. ESA

N77-29970# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.
PROPAGATION OF LARGE AMPLITUDE TORSIONAL ALFVEN WAVES [UNTERSUCHUNG DER AUSBREITUNG VON TORSIONSALFVENWELLEN GROSSER AMPLITUDEN]
E. Berger 1976 74 p refs In GERMAN
(IPF-76-2) Avail: NTIS HC A04/MF A01

The propagation of torsional Alfven waves in an amplitude range, comprising linear to strong nonlinear behavior, was investigated to obtain information on the nonlinear plasma heating mechanism. Some properties, resulting from linear theory and providing first approximations to the behavior at large amplitude, were considered. Nonlinear terms were taken in a perturbation calculation, and their effect on the wave field was examined. Results of supporting measurements are presented and discussed. ESA

N77-29971# European Space Agency, Paris (France).
INTRODUCTION TO HYDRODYNAMICS OF REACTIVE PLASMAS
Gerard Fournier Jun. 1977 48 p refs Transl. into ENGLISH of 'Introduction a l'Hydrodyn. des Plasmas Reactifs', ONERA, Paris Report ONERA-NT-1976-17, 1976 Original report in FRENCH previously announced as N77-25979
(ESA-TT-386; ONERA-NT-1976-17) Avail: NTIS HC A03/MF A01

The hydrodynamics of reactive plasmas is a synthesis of several physics disciplines outlined successively. Problems of plasma physics are considered first. They are related to the evolution of charged particle density along the flow and to the determination of the electron distribution function and macroscopic properties depending on inelastic processes. Molecule excitation is discussed; vibration excitation is emphasized since it permits derivation of simple models, it being the most coupled with the flow generally and of interest for many types of lasers. The section on chemical reactions in a flow requires some background in chemical kinetics and thermodynamics. The subjects are chosen in order to give access to a general solution with a minimum of concepts and equations. The synthesis of the previous subjects for the flow study is limited to simple aerodynamic assumptions (especially one-dimensional flow). Interaction with radiation is outlined but, the problems of stability and wall-flow interaction are not considered. Author (ESA)

N77-29972# Wisconsin Univ., Madison. Mathematics Research Center.
EXPANSION OF AN ION SHEATH INTO A COLLISION-DOMINATED PLASMA
K. E. Lonngren Mar. 1977 11 p refs
(Contract DAAG29-75-C-0224; Grant NSF ENG-76-15645)
(AD-A038967; MRC-TSR-1737) Avail: NTIS HC A02/MF A01 CSCL 20/9

If a large negative voltage is applied to an insulated disc inserted in a collision-dominated plasma, the electrons are expelled from the region near the disc leaving a bare cloud of ions. This transient sheath is well documented in ion acoustic wave experiments. This paper examines the evolution of the ions in this sheath into a collision-dominated plasma. A new sheath whose dimension is of the order of twice the transient sheath dimension is found. Author (GRA)

N77-29973# Maryland Univ., College Park. Inst. for Physical Science Technology.
NONLINEAR MECHANICS OF UNSTABLE PLASMAS AS RELATED TO HIGH ALTITUDE AERODYNAMICS Final Report, 1 Oct. 1971 - 30 Sep. 1976
H. Lashinsky 1977 31 p
(Grant AF-AFOSR-2179-72)
(AD-A038204; AFOSR-77-0213TR) Avail: NTIS HC A03/MF A01 CSCL 20/9

The program supported by this grant was devoted to extending theoretical and experimental techniques that are well-known in lumped-parameter systems such as vacuum tube oscillators and microwave devices to distributed-parameter systems such as plasmas; particular areas of interest are nonlinear behavior of oscillations and instabilities, stabilization of instabilities, and turbulence phenomena in bounded systems. The program developed a method of analysis in which the oscillations of a distributed-parameter system are treated in terms of normal modes of the bounded system. The temporal behavior of these modes is described by nonlinear differential equations that are well known from the analysis of lumped-parameter systems: These include the van der Pol equation, the Mathieu equation, the Duffing equation, and a new equation that has been developed and solved in this program. GRA

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N77-29974 Texas A&M Univ., College Station.
VIBRATIONAL PROPERTIES OF ADSORBATES AND RECONSTRUCTED SURFACE Ph.D. Thesis
William Reed Lawrence 1976 95 p
Avail: Univ. Microfilms Order No. 77-2642

Three problems were investigated: (1) Reconstruction of FCC (100) surface: it is proven that the Burton and Jura model for the reconstructed surface is mechanically unstable and the phase transition is consquently impossible. (2) Vibrational modes of adsorbed atoms: A detailed discussion is given of the vibrational spectra of seven systems. The results for mass defect models are qualitatively incorrect in two ways: the ordering of the principal modes associated with adsorbate vibrations is backwards, and the effect of the adsorbate on the substrate surface modes is too large in the case of weakly bound adsorbates. (3) Heat capacities of adsorption: For seven systems the heat capacities of adsorption is calculated. The results for Ne on Ar and Kr are in semiquantitative agreement with the experimental data of Antoniou for Ne on graphite. The results are also in qualitative agreement with the experimental data of Bretz et al., for He on graphite. Dissert. Abstr.

N77-29975 Maine Univ., Orono.
A STATISTICAL MECHANICAL ENERGY BARRIER MODEL FOR PERMEATION THROUGH MONOMOLECULAR FILMS Ph.D. Thesis
John Oliver Milliken 1976 262 p
Avail: Univ. Microfilms Order No. 77-8328

The effect of adsorbed surfactant monolayers on interfacial mass transport processes has been studied by modelling the monolayer as a hard disc fluid with the diffusing species as permeating hard spheres. Results of the hard disc-hard sphere model are discussed in terms of Barnes' mechanical analogue and with respect to experimental data for permeation through long chain paraffin alcohol and acid monolayers. In a system of 1024 monolayer particles the probabilities for hard spheres permeating the hard disc membrane were found to vanish at monolayer densities well below close packing. Experimental mass transfer coefficients of the order of the 0.1 cm/per sec can now be interpreted as indicating structural defects in the monolayer conformation at densities lower than the macroscopic crumple point. Dissert. Abstr.

N77-29976 Minnesota Univ., Minneapolis.
QUASIELASTIC LASER LIGHT SCATTERING STUDY OF PHASE TRANSITION FROM CHOLESTERIC LIQUID CRYSTAL TO ISOTROPIC FLUID Ph.D. Thesis
Balasubramanian Rajagopalan 1976 132 p
Avail: Univ. Microfilms Order No. 77-6994

The physics of liquid crystal phase transition is examined through investigations by several physical techniques. The substance studied is cholesteryl oleyl carbonate, C46H8003, which becomes a cholesteric liquid crystal below T sub c 35.2 C. Experiments with polarisation microscopy, differential scanning calorimetry, nuclear magnetic resonance, capillary viscometry, and polarimetry establish that the phase transition is not sharp, but instead is spread about two degrees around 34.0 C. The transition is a weak first order one with a latent heat of 0.642 cals/gm. The dynamics of the transition is studied by light beating spectroscopy. Inelastic light scattering data is collected in the intermediate temperature region where the transition is taking place. Light scattering properties of cholesteryl oleyl carbonate change continuously upon cooling from the isotropic phase to the cholesteric phase without a detectable first order phase transition. Dissert. Abstr.

N77-29977 Cornell Univ., New York.
HIGH BRIGHTNESS FIELD EMISSION ELECTRON PROBE FORMING SYSTEMS Ph.D. Thesis
Huei Pei Kuo 1976 202 p
Avail: Univ. Microfilms Order No. 77-8390

A field emission electron source with high angular current density and two high brightness electron probe forming systems were developed. The nitrogen processing technique for a tungsten field emitter provide a concentrated beam in the forward direction. A complete illumination system for a high resolution experimental electron microscope (HREM) was designed. Attention was paid to the optimization of an electrostatic pre-accelerator lens with minimum spherical and chromatic aberrations. The complete illumination system was experimentally evaluated using the HREM as the measuring system. A prototype probe forming system capable of producing an even higher brightness and beam current was designed and evaluated. A computer optimized magnetic preaccelerator lens was used instead of the electrostatic lens. Dissert. Abstr.

N77-29978 Florida Univ., Gainesville.
K- AND L-SHELL X-RAY PRODUCTION CROSS SECTIONS FOR ALPHA PARTICLES IN THE 1 TO 4 MeV RANGE ON SELECTED THIN TARGETS Ph.D. Thesis
Christopher Graham Soares 1976 105 p
Avail: Univ. Microfilms Order No. 77-6906

Total K-shell X-ray production cross sections were measured for 1.0 to 4.4 MeV alpha particles on Ti, V, Mn, Fe, Co, Ni, Cu, Zn, Ge, and Se. Also, K (alpha) and K (beta) production cross sections were measured for 1.5 to 4.25 MeV alpha particles on Y, Ag, and Sn, while 1.0 to 4.0 MeV alpha particles were used to measure L (script l), L (alpha), L (beta), L (gamma sub 1), and L (gamma sub 2,3,6) production cross sections for Hf, Au, Pb, and U. All data was taken with thin targets evaporated onto thin carbon backings. The measured cross sections were compared to the predictions of the binary encounter approximation (BEA), the plane-wave Born approximation (PWBA), the PWBA with binding energy corrections (PWBAB), the PWBA with Coulomb trajectory corrections (PWBAC), and the PWBA with both the above corrections (PWBABC). Dissert. Abstr.

N77-29979 State Univ. of New York, Stony Brook.
VARIATIONAL AND SPHERICAL APPROXIMATIONS IN THE STUDY OF CRITICAL PHENOMENA AND PHASE TRANSITIONS Ph.D. Thesis
Ayse Erzan 1976 133 p
Avail: Univ. Microfilms Order No. 77-7786

The spherical model, mean spherical model, and the thermodynamic variational approximation are discussed from the point of view of thermodynamic consistency. The scaling behavior of the spherical model in the region of an isotropic Lifshitz point in 2 less than d less than 4 dimensions is investigated, and an interpretation of the Lifshitz point is given. The thermodynamic variational approximation is utilized to obtain a quite accurate approximation to the phase diagram and tricritical behaviour of He3 - He4 mixtures. The results compare very well with those obtained by means of series extrapolation techniques, and are a great improvement over the mean field theory solution. The thermodynamic variational approximation is applied to the Gaussian integral representation of the partition function of a system of permanent diposes. Upper and lower bounds to the free energy, which are believed to be very close, are obtained, as well as the Clausius-Mosotti function. Dissert. Abstr.

N77-29980 Purdue Univ., Lafayette, Ind.
MOESSBAUER STUDY OF DEFECT ASSOCIATIONS IN WUESTITE AND ALKALI HALIDES Ph.D. Thesis
Hans Raj Anand 1976 175 p
Avail: Univ. Microfilms Order No. 77-7408

Defect properties of wuestite and iron doped LiF and NaF were studied with the Moessbauer effect. The diffusive broadening in wuestite was found to be proportional to the tracer diffusivity (Ch 75), but the amount of broadening observed was substantially less than that predicted by Singwi and Sjolander for uncorrelated diffusive motion in the sudden jump approximation (Si 60). Diffusive broadening was observed to be accompanied by an anomalous falloff in the recoil-free fraction. No deviation from Lorentzian line shape, however, was observed within the experimental errors. The diffusive broadening, for the temperature region 800 - 1050 C, was seen to decrease with an increasing vacancy concentration at lower temperatures and remain unaffected by nonstoichiometry at higher temperatures. The compositional dependence of broadening points to the role of vacancy clustering in wuestite (Ho 74, Ko 69). Dissert. Abstr.

N77-29981 Virginia Univ., Charlottesville.
PRECISION LATTICE MEASUREMENTS OF SINGLE CRYSTALS OF GERMANIUM AND SILICON Ph.D. Thesis
Paul Emil Zanzucchi 1976 221 p
Avail: Univ. Microfilms Order No. 77-7564

A computer program plotted and indexed pseudo-Kossel diffraction lines. The analysis showed that the most favorable back-reflection patterns for single crystals of Ge would be given by the combination of CoK alpha 1 radiation and the [620] reflecting planes, and for Si the combination of Ge K alpha 1 radiation and the [751] or [555] reflecting planes. In these cases, as the Bragg angle tends to 90 degrees, the derivatives of lattice parameter with respect to angle of incidence and of angle of incidence with respect to wavelength increase rapidly. The values of the lattice parameter at 25 C measured for two Ge crystals were 5.65794 and 5.65802 coefficient of linear thermal expansion at 25 C was 0.0000539 per C. The lattice parameter at 25 C for one Si crystal was found to be 5.4314A. Dissert. Abstr.

N77-29982 Florida State Univ., Tallahassee.
THE EFFECTS OF ION IMPLANTED Gd ON THE SUPERCONDUCTING PROPERTIES OF THIN Nb FILMS Ph.D. Thesis
Paul David Scholten 1976 81 p
Avail: Univ. Microfilms Order No. 77-8616

Gd ions of concentrations between 0.125 and 9.0 at. percent were implanted into the Nb films at energies of 50, 100 and 150 keV. The distribution of Gd ions at these energies was measured by nuclear-backscattering techniques. The T sub c and I sub c were strongly dependent upon the Gd distribution. The depression of T sub c and I sub c increased with increasing implantation energies corresponding to increased penetration. For each energy, both T sub c and I sub c showed a rapid decrease for low concentrations of Gd which then leveled off as the concentration increased up to a few atomic percent. I sub c was depressed about five times as much as T sub c at low Gd concentrations. The T sub c data was qualitatively described by a proximity effect theory while a film thinning model described the depressions of I sub c. Dissert. Abstr.

N77-29983 Wisconsin Univ., Milwaukee.
SURFACE STRUCTURE DETERMINATION BY MICROSCOPIC LOW ENERGY ELECTRON DIFFRACTION THEORY Ph.D. Thesis
Norman Lee Stoner 1976 110 p
Avail: Univ. Microfilms Order No. 77-7643

A derivation and discussion of the state of the art LEED techniques are given. Of these, the appropriate techniques were used to obtain surface structure results for the Al(001)-c(2x2)Na overlayer system and the irrationally related Ag(111)-Xe overlayer system. The d-spacing, preferred binding site, and the bond length were found for the Al-Na system. New techniques were developed to enable full dynamical LEED methods to be used on overlayer systems with incommensurate lattices. Results of the first successful structural determination for this type of system by using full dynamical LEED methods were studied. The d-spacing for Ag(111)-Se was determined to be 3.5 + or - .1 A. Temperature studies were done on the Al(001) and Ni(001) crystal planes. New techniques were developed to study the layer dependent amplitudes of vibration of the atoms in the planes. Dissert. Abstr.

N77-29984 Stanford Univ., Calif.
THE ELECTRODYNAMICS OF THE LAYERED ELECTRON GAS IN THE HYDRODYNAMIC AND TIGHT-BINDING MODELS Ph.D. Thesis
Owen Dale Roberts 1976 74 p
Avail: Univ. Microfilms Order No. 77-7159

Two theoretical studies of the electrodynamics of the layered electron gas are presented. This electron gas was used as a model for various physical systems with electrons confined to a planar geometry but relatively free to move in two dimensions. Examples of such systems in nature include both single layers, such as inversion layers at the interface between a semiconductor and an insulator, and arrays of layers, such as the transition metal dichalcogenides. The first of the theoretical studies uses the random phase approximation (RPA) to compute the polarization propagator, which determines the behavior of the collective excitations (plasmons) of the electron gas. The second study uses a hydrodynamic model to compute the reflectance of the layered electron gas. Dissert. Abstr.

N77-29985 Arizona State Univ., Tempe.
CACULATIONS OF THE FIRST-ORDER RAMAN SPECTRA AND THE ASSOCIATED ELECTRON-PHONON INTERACTION OF POINT DEFECTS IN ALKALI: HALIDES Ph.D. Thesis
Dennis Irving Robbins 1976 287 p
Avail: Univ. Microfilms Order No. 77-8134

Calculations are presented for the first-order defect-induced Raman specta of the Tl+ impurity and the F center in alkali halides. Results of a subsidiary calculation of the stress-dependence of the F band electronic transition energy of the F center are included. For the Tl+ impurity, the lineshape of the first-order off-resonance Raman scattering from Eg modes in Tl+ -diped Kl, KB, and KCl, is calculated for the case when the electronphonon interaction is a linear function of the defect's second nearest as well as its nearest neighbors. For the F center, ab intio calculations of the electronphonon coupling terms associated with defect-induced Raman scattering are presented, based on two different quantum mechanical models for the electron-phonon interaction. Dissert. Abstr.

N77-29986 Yeshiva Univ., New York.
THE STUDY OF OPTICAL PROPERTIES OF TRANSITION METAL OXIDES EXHIBITING SEMI-CONDUCTOR-TO-METAL (SCM) TRANSITION Ph.D. Thesis
Samuel San-Mau Lu 1977 185 p
Avail: Univ. Microfilms Order No. 77-8897

Experiments of: (1) Near normal incident reflectances of Ti2O3, TiO2, NBO2, and NB(L-X)TIXO2. (2) Angular dependent reflectance measurements of TI2O3, NBO2 and NB(L - X)TIXO2;

(3) Electroreflectance of NB(L - X) TIXO2 X = 0.05 and annealed TIO2; and (4) Temperature dependent transmission on TIO2 and field dependent transmission on NBO2 are reviewed. For reflectance measurements, the single crystals of TI2O3, NBO2, and NB(L - X)TIXO2 were grown by the Czochralski-Kyropoulos technique in a tri-arc furnace. All samples were then oriented by X-ray machine, polished, and etched. The near normal incident reflectances were measured in the range of 0.5 - 10 eV. by rotating light pipe reflectometer, with electric field of incident light polarized along a- and c-axis. The measurements above 6 eV. were performed in vacuum. The real part and imaginary part of dielectric constants were determined by Kramers-Kronig analysis combined with angular dependent reflectance measurements at certain laser wavelength.

Dissert. Abstr.

N77-29987 Johns Hopkins Univ., Baltimore, Md.
MICROWAVE HALL MOBILITY AND RECOMBINATION LIFETIME STUDIES OF SOME INSULATORS AND SEMICONDUCTORS Ph.D. Thesis
Yuh-lin Liang 1976 136 p
Avail: Univ. Microfilms Order No. 77-7744

A cylindrical dual-mode cavity technique was used to study the microwave Hall mobility of selenium samples prepared by various methods. A large p-type Hall mobility was theoretically predicted and was found experimentally. The results are compared to the carrier drift mobility determined by a time-of-flight method. A model justifying the value of observed mobilities determined from the different measurements is discussed. The transient photo-conductivity decay of selenium samples studied by means of microwave cavity and waveguide absorption indicated that in addition to the ordinary exponential decay of excess carriers found in crystalline silicon and germanium, there exists in selenium a long-lived conductivity after the light is removed. A model for the dynamics of the excess carriers' trapping and recombination is presented to explain these results.

Dissert. Abstr.

N77-29988 Stanford Univ., Calif.
EXPERIMENTAL SURFACE SHIELDING EFFECT INSIDE A COPPER TUBE Ph.D. Thesis
James Marcus Lockhart 1976 188 p
Avail: Univ. Microfilms Order No. 77-7122

The temperature dependence of the ambient axial electric field inside a vertical copper tube has been investigated. A vertical metal tube subject to the gravitational field of the earth is expected to have spatial variations in the electrostatic potential along its axis because of contact potential differences between adjacent crystals in the metal and because of the gravitationally-induced rearrangements of the metallic electrons and ions. The slow electron time-of-flight method which was used to study the ambient field is discussed and the versions of the apparatus used at 300 K, 77 K, and 4.2 K are described. A drift tube heater and temperature monitor system is designed which allows the 4.2 K version of the apparatus to be used over the range 4.2 K-11 K. The manner in which ambient fields are measured is discussed in detail, as is the effect of the delayed emission of electrons from electrostatic and magnetic potential traps.

Dissert. Abstr.

N77-29989 California Univ., Santa Barbara.
PROBLEMS IN PHASE TRANSITIONS OCCURING IN QUASI-ONE DIMENSIONAL CONDUCTORS Ph.D. Thesis
Sohail Jafarey 1976 136 p
Avail: Univ. Microfilms Order No. 77-8551

The effect of an interchain bandwidth on the Peierls transmission in quasi one dimensional metallic systems is studied within the random phase approximation, using a two dimensional model. The possibility of charge transfer phase transitions is investigated in a model of electrostatically coupled linear chain systems. In this model, intramolecular electron-electron Coulomb correlations are included by using Hubbard Hamiltonians for the donor and acceptor chains. Solutions of the Hubbard Hamiltonian in the weak correlation and extremely strong correlation limits are used. The variation of the charge transfer with temperature is studied using a mean field approximation for the intermolecular Coulomb interactions. The specific heat and the paramagnetic spin susceptibility are calculated. It is found that for a range of interaction parameters charge transfer phase transitions are possible. Dissert. Abstr.

N77-29990 Denver Univ., Colo.
AN INVESTIGATION OF THE DEFORMATION OF IRON USING ACOUSTIC EMISSION AND INTERNAL FRICTION TECHNIQUES Ph.D. Thesis
Frank Patrick Higgins 1977 136 p
Avail: Univ. Microfilms Order No. 77-7383

The internal friction and acoustic emission generated during the deformation of iron was investigated to identify the sources of the acoustic emission and to better understand the microscopic properties of deformation. The independent damping was measured simultaneously with the acoustic emission while deforming the iron. A Marx piezoelectric oscillator resonating at 50 kHz was utilized to make the damping measurements. Damping versus strain amplitude measurements were made prior to and following each deformation. Acoustic emission was observed in the elastic region, and at the onset of plastic deformation. Substantial acoustic emission generated in the elastic region and decreased with increasing stress. The acoustic emission then increased at the onset of plastic deformation. Analysis of the data revealed that dislocation processes were the source of acoustic emission at the onset of plastic deformation.

Dissert. Abstr.

N77-29991 Florida Univ., Gainesville.
NUCLEAR MAGNETIC RESONANCE OF N-14 IN SINGLE CRYSTAL GLYCINE AND OF N-15 IN LIQUID AND SOLID N2 Ph.D. Thesis
Lyle Milton Ishol 1976 172 p
Avail: Univ. Microfilms Order No. 77-6878

Quadrupole perturbed magnetic resonance (NMR) was used to determine the quadrupole coupling constant, asymmetry parameter, and electric field gradient (EFG) tensor in single crystal glycine. As the temperature increased, coupling constant decreased. These results are consistent with earlier work, except there is no evidence of a significant change in the orientation of the EFG tensor at higher temperatures. The NMR spectrum of N-15 in alpha-phase solid (N2)-15 with paramagnetic O2 impurity added were determined as a function of magnetic field and O2 concentration. A classical Pake doublet was obtained at 650 G as expected; however, the spectrum became increasingly asymmetric as the field was increased to a maximum of 9 kG. Dissert. Abstr.

N77-29992 California Univ., Los Angeles.
ANALYSIS OF PLASTIC DEFORMATION OF BICRYSTALS Ph.D. Thesis
Edmond Guang-Wu Chow 1976 90 p
Avail: Univ. Microfilms Order No. 77-8507

A bicrystal grain boundary acts as a restraint to the plastic deformation in the adjoining grains. Since the grain boundary hinders slip, the presence of such an obstacle to slip introduces a finite discontinuity of slip strain across the grain boundary. Based on the condition that slip starts or continues when the resolved shear stress equals critical shear stress, the distribution of incremental slip field at successive load increments is expressed as an integral equation of incremental plastic strains. Numerical procedures are developed in these calculations. This analysis satisfies both the continuity of displacement and the equilibrium of stresses across the grain boundary. Heterogeneous slip and stress fields of an incompatible isoaxial bicrystal are calculated at different stages of tensile straining. The early stage of stress-strain curve for the bicrystal is obtained. Dissert. Abstr.

N77-29993 Notre Dame Univ., Ind.
HIGH FIELD CONDUCTION AND CURRENT NOISE IMPLICATIONS OF MECHANISMS CONTRIBUTING TO BREAK DOWN IN THIN FILMS OF RbI Ph.D. Thesis
Jong Gil Lee 1977 90 p
Avail: Univ. Microfilms Order No. 77-8707

The structure control of the film was performed by the thin, high resistance top electrode which limits the flow of the stored capacitor charge to the high conduction region thereby limiting the rate of energy dissipation. Evidence of space charge build-up is presented by memory in I-V characteristics, decrease of onset time of self-healing breakdown in second pulse with delay time

between the first and second applied pulses, and abrupt increase of conduction at the beginning of opposite polarity second pulse. Current oscillation is also observed upon the application of rectangular pulse. Current is voltage and time dependent and current saturates in the long time range, approximately 1 second. There is threshold voltage at 3.9 + or - 0.1 eV which coincides with electron-impact onset for excitation of intrinsic luminenscence of thin film RbI. Dissert. Abstr.

N77-29994 Illinois Univ., Urbana-Champaign.
SHAPE MEMORY PHENOMENA IN COPPER-ZINC SINGLE CRYSTALS Ph.D. Thesis
Terrence Alan Schroeder 1976 261 p
Avail: Univ. Microfilms Order No. 77-9173

The shape memory effect and related phenomena were investigated using single crystals of Cu-Zn alloys of nominal composition Cu -40 wt% Zn. The determined mechanical properties were correlated with the deformation mechanisms observed in similarly oriented specimens which were strained on an optical microscope stage. The use of polarized light and the diamond type of morphology assumed by four self accommodating martensite plate variants allowed identification of each of the four variants and the corresponding deformation behavior of each. The crystal structures involved and transformation relationships were determined by X-ray analysis. The origin of the shape memory effect lies in the conversion of a single orientation of martensite to a single orientation of the parent during heating. The amount of deformation obtained in the martensite is usually less than that theoretically possible because of advanced deformation phenomena. Dissert. Abstr.

N77-29995 Rhode Island Univ., Kingston.
INVESTIGATION OF SOME THERMOTROPIC LIQUID CRYSTALS BY INFRARED AND RAMAN SPECTROSCOPY
Ahmad Azima 1976 123 p
Avail: Univ. Microfilms Order No. 77-7623

The spectral data were used to study the effect of temperature, external forces and hydrogen bonding on the structures of the mesomorphic phases. Temperature studies of the infrared spectra of p-n-benzoic acid (HOBA) and p-n-octoxybenzoic acid (OBA) showed that a direct correlation exist between the phases and the type and extent of the hydrogen bonding. Spectra of both liquid crystals in dilute CCl4 solutions were measured as a function of concentration and temperature. Bands due to the O-H and C=O vibrations of the monomers, and cyclic dimers were observed in the spectra of the dilute solutions. Infrared spectra of four p-n-alkoxygenzoic acid homologues were also measured in all thermotropic phases over the spectral region between 650-1600 cm to the -1 power. Dissert. Abstr.

N77-29996 Illinois Univ., Urbana-Champaign.
PROTON SPIN-LATTICE RELAXATION IN CROSS LINKED POLYBUTADIENE Ph.D. Thesis
Lance Confer Labun 1976 118 p
Avail: Univ. Microfilms Order No. 77-9060

The nuclear spin-lattice relaxation time of protons in cis-polybutadiene was measured for a series of samples with crosslink densities corresponding to average network chain lengths ranging from 3 to 337 repeat units. For each sample time was measured at 9MHz over a wide temperature range around the time minimum (-39 C for uncrosslinked PB). All samples except one show a definite minimum in time when plotted against 1/T, however, the slopes of the lines for temperatures above the minima are lower than those for temperatures below the minima. The slope on the high temperature side decreases markedly with decreasing network chain length. Because the minimum does not move significantly until the network chain length has been reduced to approximately 10 repeat units, the value of time at a given temperature above time minimum decreases as the slope decreases. Dissert. Abstr.

N77-29997 Stanford Univ., Calif.
THE FIELD EFFECT IN AMORPHOUS CHALCOGENIDES Ph.D. Thesis
John Edward Mahan 1976 202 p
Avail: Univ. Microfilms Order No. 77-7124

Changes in source-to-drain resistance due to an applied transverse electric field as a function of temperature were measured in four amorphous chalcogenides. AS2TE3 shows a transition from localized state - to mobile carrier controlled screening as the temperature is raised, and a transition from p-type to 2-carrier conductivity. AS2SETE2 and AS2SE2TE are strongly p-type: the former exhibits primarily mobile carrier screening and the latter, localized state screening only. SB2TE3 has 2-carrier conductivity and localized state screening of the field effect. Correlation with thermoelectric power results suggests a two channel model of conduction: hopping in localized hole states plus simultaneous conduction in extended valence states. Dissert. Abstr.

N77-29998 Florida Univ., Gainesville.
DETERMINATION OF ELECTRONIC PROPERTIES OF MATERIALS USING DIFFERENTIAL REFLECTOMETRY Ph.D. Thesis
Rosalia Josephine Nastasi 1976 196 p
Avail: Univ. Microfilms Order No. 77-8203

A differential reflectometer was used to determine the energy for interband transitions of electrons in a large range of phase copper based alloys. The colutes used included elements with one, two, three, four, and five valence electrons. Important parts of the line shape of the differential reflectograms were reproduced by taking the derivative of a quantum mechanical expression for the reflectivity with respect to alloy composition. This treatment confirms the assumption that the structure in the differential reflectograms is caused by electron transitions. The threshold energy for alpha band to Fermi energy transitions does not change for alloy compositions up to approximately 1 at.% solute concentration. The Fermi energy level is raised much less due to solute addition than predicted by the rigid band model; the d-bands are possibly raised by alloying. Dissert. Abstr.

N77-29999# Rockwell International Science Center, Thousand Oaks, Calif.
RAMAN SCATTERING STUDIES OF THE GaAs NATIVE OXIDE INTERFACE Final Report, 1 Jan. 1975 - 31 Dec. 1976
J. A. Cape, W. E. Tennant, and L. G. Hale 24 Feb. 1977 16 p refs
(Contract N00014-75-C-0345)
(AD-A036244; SC5014.6FR) Avail: NTIS HC A02/MF A01 CSCL 20/12

Oxide films grown by heat treatment on the 100 and 111 faces of GaAs have been studied by Raman backscattering. A spectra consisting of the bulk LO and TO lines of GaAs and two additional lines labeled R1 and R2 is observed on all samples prepared at temperatures above 435 C. The additional modes are attributed to an interface region of perhaps several hundred angstroms thickness beneath the oxide film. GRA

N77-30000# Arizona State Univ., Tempe. Dept. of Physics.
WORKSHOP ON HIGH RESOLUTION MICROSCOPY
1976 169 p refs
(Contract W-7405-eng-48)
(PUB-106) Avail: NTIS HC A08/MF A01

The many facets of microscopy at atomic resolution including theory, instrumentation, application, and the need for a national facility to accomplish the goals are discussed in detail. Materials science, mineralogy, ceramics, solid-state chemistry, image interpretation, microdiffraction, microanalysis, radiation damage, and instrumentation are covered. Author (ERA)

N77-30001# Texas Instruments, Inc., Dallas. Equipment Group.
JOSEPHSON JUNCTION TECHNOLOGY PROGRAM, PHASE 1 Final Report, 4 Oct. 1976 - 21 Apr. 1977
Forrest D. Colegrove, Spencer A. Buckner, David N. McQuiddy, and Jerry D. Holmes 21 Apr. 1977 57 p refs
(Contract N00173-76-C-0388)
(AD-A039598) Avail: NTIS HC A04/MF A01 CSCL 09/1

A search has been made of Naval Surveillance and communications systems in the frequency range DC to above 100 GHz for the purpose of identifying systems in which the application of Josephson effect devices might improve performance. Magnetic anomaly detection, ELF communications, fast digital processing and some radar applications were examined and found to be

potential candidates for superconducting devices. Analyses of systems considered and rejected are also included. Author (GRA)

N77-30002# Massachusetts Inst. of Tech., Cambridge. Fluid Dynamics Research Lab.
REACTION PROBABILITIES IMPLIED BY MULTIPLE GAS-SURFACE INTERACTIONS
J. R. Williams and J. R. Baron Dec. 1976 67 p refs
(Contract F44620-75-C-0040; AF Proj. 2307)
(AD-A036446: Rept-76-1; AFOSR-77-0102TR) Avail: NTIS HC A04/MF A01 CSCL 20/8

The probabilities of single and two successive gas surface collisions satisfying minimum interaction energy cutoffs are considered in the hard cube model sense. Comparison is made with atomic and molecular oxygen reaction probabilities with graphite corresponding to specific mass ratio examples of 4/3 and 8/3. Comparable peak probabilities result for multiple interactions but of much reduced sharpness with temperature for only a two collision constraint. Realistic activation energies are implied from a match of the energy cutoff probability model to the portion of the experimental data increasing with surface temperature. The rapidly decreasing reaction probabilities found experimentally at higher temperatures imply an appreciable increase in the required number of effective collisions.
Author (GRA)

N77-30003# Army Materials and Mechanics Research Center, Watertown, Mass. Metals Research Div.
THE EFFECT OF THE K ALPHA DOUBLET DIFFRACTED PEAR POSITION ON THE PRECISION OF THE LATTICE CONSTANT Final Report
Charles P. Gazzara Nov. 1976 18 p refs Presented at the 25th Annual Denver X-ray Conf., Denver, Colorado, 5 Aug. 1976
(DA Proj. 1T1-61102-AH-42)
(AD-A036442; AMMRC-TR-76-37) Avail: NTIS HC A02/MF A01 CSCL 20/2

The effect of the position of the X-ray unresolved K sub alpha 1-K sub alpha 2 line doublets, diffracted from powder specimens, on the precision of the calculated lattice constant has been determined using a least-squares analysis. Suggestions to increase the precision of the lattice constants determined from X-ray diffraction powder samples are presented. GRA

N77-30004# Harry Diamond Labs., Adelphi, Md.
RARE EARTH ION-HOST LATTICE INTERACTIONS. 7: LANTHANIDES IN YVO-4
Nick Karayianis, Donald E. Wortman, and Clyde A. Morrison Aug. 1976 92 p refs
(DA Proj. 1T1-61102-AH-46)
(AD-A040905; HDL-TR-1775) Avail: NTIS MF A01 CSCL 20/5

Phenomenological even-fold crystal-field parameters, Bkm, have been found that give a least rms deviation of 2.6/cm between 24 calculated and measured energy levels of the ground term of Nd(3-) in YOV4. These Bkm are in close agreement with those that yield a least rms deviation of 8.5/cm between 52 calculated and measured energy levels for Nd(3-) and with values reported previously that were calculated by the use of a different free-ion Hamiltonian. A smooth set of Bkm(Ln) for all the lanthanides in YVO4 were then obtained by multiplying the previously reported Bkm(Nd) values in YVO4 by the Bkm (Ln)/Bkm (Nd) ratios found for the lanthanides in YPO4 (more experimental data were available for computing Bkm for the lanthanides in YPO than for YVO4). Crystal-field components, Akm, were determined by a sum over the YVO4 lattice. These Akm were used with appropriate Bkm, radial integrals, and energy positions of the higher electronic configurations to calculate squared matrix elements of the electric dipole operator between the Stark split energy states of the ground configuration for the triply ionized lanthanides in YVO4. GRA

N77-30005# Harry Diamond Labs., Adelphi, Md.
CHARGE YIELD AND DOSE EFFECTS IN MOS CAPACITORS AT 80 K
Harold E. Boesch, Jr. and James M. McGarrity May 1977 36 p refs
(AD-A039537; HDL-TR-1806) Avail: NTIS HC A03/MF A01 CSCL 20/12

The response of metal-oxide semiconductor capacitors to short-pulse high-energy electron irradiation was measured at 80 K. It was confirmed that radiation-generated holes are almost totally retained in the SiO2 layer regardless of oxide processing; this retention was exploited to determine carrier yield as a function of applied electric field. Evidence was found that the holes undergo an initial displacement under an applied field immediately following carrier generation (9.5 nm at 1,000,000 V/cm). Samples were subjected to pulsed irradiation at 80 K to accumulated doses above 1,000,000 rads (SiO2) and mechanisms which limit hole buildup above 50,000 rads (SiO2) were explored. Electron-hole recombination in a low field region of the SiO2 was identified as an important process and was modeled. Other mechanisms discussed include electron injection, field- and temperature-activated hole transport, applied field collapse, and dielectric breakdown. Author (GRA)

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N77-30006 Illinois Univ., Urbana-Champaign.
MOLECULAR THERMODYNAMICS AND KNUDSEN CELL-MASS SPECTROMETER STUDIES OF LIQUID METAL MIXTURES Ph.D. Thesis
Michael Edward Paulaitis 1976 188 p
Avail: Univ. Microfilms Order No. 77-9140

An experimental determination of the thermodynamic activities of each component in the Cu-Sn liquid metal system was made using a Knudsen cell-mass spectrometer technique which utilizes a rotating mass spectrometer and multiple, isothermal Knudsen cells to provide an in situ calibration of the mass spectrometer. This technique permits the direct and independent measurement of the activity of an individual specie in solution. A solution model of liquid metal mixtures is also presented using the molecular theory of corresponding states and hard sphere perturbation theory to predict thermodynamic properties of mixtures of mixtures from pure component properties. Using no adjustable parameters, the model is applied to binary, simple eutectic mixtures of liquid metals and a comparison is made between predicted excess energies and experimental results. The use of liquid metals as solvents in industrial ore reductions and separation processes is also discussed. Dissert. Abstr.

N77-30007 Purdue Univ., Lafayette, Ind.
HIGH TEMPERATURE GAS DIAGNOSTICS BY REMOTE INFRARED SPECTRAL EMISSION MEASUREMENTS Ph.D. Thesis
Paul James Hommert 1976 233 p
Avail: Univ. Microfilms Order No. 77-7470

The use of spectral emission measurements in determining line of sight temperature and/or concentration distributions in high temperature gaseous systems was investigated. An analytical model was constructed which relates the emitted spectral intensity to the local temperature and radiating species concentration within the gas. The mathematical statement of the model leads to a series of integral equations, one for each frequency at which data is taken. The profiles within the gas are determined by inverting these integral equations through the use of a parameter estimation inversion technique. Experimental verification studies were conducted using CO2/N2 mixtures at temperatures varying from 700 to 1350 K, and a flat CH4 air diffusion flame producing a gas envelope temperature varying from ambient to about 2000 K in less than 1 cm. Dissert. Abstr.

N77-30008# Sandia Labs., Albuquerque, N. Mex. Computational Physics and Mechanics Div.
OPERATOR SPLITTING, METHOD OF CHARACTERISTICS AND BOUNDARY VALUE ALGORITHMS

D. L. Hicks and M. M. Madsen Dec. 1976 60 p refs
(Contract E(29-1)-789)
(SAND-76-0436) Avail: NTIS HC A04/MF A01

The conservation laws of continuum mechanics and the divergence-form expressions of these laws are considered. After splitting the three-dimensional equations into a system of one-dimensional equations, the method of characteristics may be applied to construct boundary-value algorithms for wavecodes. A procedure is prescribed and illustrated on several constitutive relations. This procedure produces boundary-value algorithms (based on the characteristics) for two- and three-dimensional wavecodes. A wavecode based on operator splitting and the method of characteristics is included and the advisability of constructing general multidimensional wavecodes based on this approach is discussed. ERA

N77-30009# Stanford Linear Accelerator Center, Calif.
NONPERTURBATIVE APPROACH TO QUANTUM FIELD THEORIES: PHASE TRANSITIONS AND CONFINEMENT
S. Yankielowicz Aug. 1976 78 p refs
(Contract EY-76-S-03-0326)
(SLAC-PUB-1800) Avail: NTIS HC A05/MF A01

Phenomena are discussed for which the usual weak coupling perturbative approach in terms of Feynman diagrams is of no assistance. Properties associated with large distance behavior, i.e., phase transitions, low lying spectra, coherent excitations which are presumably built out of the long wave structure of the theory are described. These methods are of value in the study of strong coupling field theories and the question of quarks confinement. ERA

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N77-30010*+ National Aeronautics and Space Administration, Washington, D. C.
MANAGEMENT: A CONTINUING LITERATURE SURVEY WITH INDEXES, MARCH 1977
Mar. 1977 110 p
(NASA-SP-7500(11)) Avail: NTIS HC A06 CSCL 05A

This literature survey lists 346 reports, articles, and other documents introduced into the NASA scientific and technical information system in 1976. Author

N77-30011# Cambridge Univ. (England). Dept. of Engineering.
[RESEARCH ACTIVITIES OF THE DEPARTMENT OF ENGINEERING] Annual Report for the academic year 1975-1976
W. A. Mair 1976 20 p refs
Avail: NTIS HC A02/MF A01

Activities for the year 1975/76 in the following areas are reported: acoustics; applied thermodynamics; control, management system and computer aided design; electrical; fluid mechanics; materials; mechanics; soil mechanics; and structures. An extensive bibliography of published papers is included. ESA

N77-30012# DeKalb County Board of Commissioners, Ga.
THE SATAF APPROACH FOR DEVELOPMENT
Roy M. Handsel Nov. 1976 42 p refs
(AD-A038044) Avail: NTIS HC A03/MF A01 CSCL 05/1

The purpose of this report was to examine the Site Activation/Alteration Task Force (SATAF) approach for accomplishment of the deployment phase of a major USAF weapon system. A research for all applicable directives and information pertaining to weapon system deployment was concluded and then condensed in Section II of the study. An in-depth review of the formation on the F-15 aircraft SATAF is presented. The study then focuses on the step-by-step process used by the SATAF II which prepared the first operational F-15 Tactical Figher Wing. From the data reviewed and personal testimony obtained from interviews with key persons it is concluded that the SATAF II was highly successful and that a similar type organization needs to be used for all major weapon systems deployment. This report should provide an understanding of the SATAF process and provide information for persons dealing in the deployment phase. Author (GRA)

N77-30013# Rowland and Co., Haddonfield, N. J.
IN SUPPORT OF TECHNICAL DEVELOPMENT PLAN 43-03X, EDUCATION AND TRAINING Final Report, 1 Dec. 1969 - 15 Nov. 1976
Edward Marlowe and George E. Rowland 15 Nov. 1976 54 p refs
(Contract N00014-74-C-0269; NR Proj. 154-353)
(AD-A038346; R/C-76-12-124) Avail: NTIS HC A04/MF A01 CSCL 05/9

This is the final technical report on a five-phase program to develop a Data Management System and a Student Management System. These findings pertain to the naval air training system features that impact on the enhancement of individualized student pilot training treatment and on student training success prediction capabilities and options. The Data Management System (DMS) was designed and implemented on to a Nova 800 minicomputer to demonstrate the feasibility of operation. This DMS is a user-oriented online system which permits non-programmer or non-computer type personnel to create data base files, update these files, search single or multiple files, and to secure hard copy printouts of search results. A unique feature is provided which permits users to execute certain descriptive and analytic statistics on records located by the search. The Student Management System consists of a description and specification of the concept, products and records required to enhance and individualized student naval pilot training treatment program. These student profiles form the quantitative bases from which administrative training personnel can select individualized treatment options. GRA

N77-30014# Naval Postgraduate School, Monterey, Calif.
DESIGN CONSIDERATIONS AND CRITERIA FOR A MANAGEMENT INFORMATION AND CONTROL SYSTEM FOR THE SIDEWINDER PROGRAM OFFICE, NAVAL WEAPONS CENTER, CHINA LAKE, CALIFORNIA
John Franklin McClain, III and Ronald Wayne Doucette Mar. 1977 144 p refs
(AD-A039773) Avail: NTIS HC A07/MF A01 CSCL 05/1

This thesis examines, specifically, the needs and criteria for a Management Information and Control System (MICS) to adequately fulfill the control and planning aspects of the program management process at the Sidewinder Program Office at NWC (SPO/NWC). The authors discuss the considerations and criteria appropriate for a viable MICS in general application and examine the existing SPO/NWC environment and MICS. Roles, responsibilities, information flows, and controls with respect to the SPO/NWC are identified. The authors stipulate the information and control requirements necessary to ensure successful SPO/NWC accomplishment of responsibilities and conclude that the current system is inadequate. They present a conceptual model of a MICS which would provide the planning and control capabilities required. GRA

N77-30015# University of Southern Calif., Los Angeles.
INTERDISCIPLINARY RESEARCH MANAGEMENT IMPROVEMENT Final Report, Jul. 1973 - Dec. 1974
Zohrab A. Kaprielian and Jack M. Nilles Jul. 1975 201 p refs
(Grant NSF NM-39528)
(PB-265011/7) Avail: NTIS HC A10/MF A01 CSCL 05A

An understanding of the extent, variety, and commonality of interdisciplinary research management problems, approaches and alternatives in major universities within the United States;

a forum, by means of a workshop, for discussion of these issues; and dissemination of information concerning recommended techniques for interdisciplinary research management in various institutional settings are reported. GRA

N77-30016# American Univ., Washington, D.C. Center for Technology and Administration.
INDIRECT COSTS IN UNIVERSITY RESEARCH. PRELIMINARY FINDINGS FROM THE RESEARCH MANAGEMENT IMPROVEMENT PROGRAM
Lowell H. Hattery Apr. 1977 278 p refs
(Grant NSF DS-176-08847)
(PB-266621/2) Avail: NTIS HC A13/MF A01 CSCL 05A

The issue of indirect cost allowances for federally-sponsored university research is addressed in five research management improvement projects conducted at American University. The text of each study is presented along with a list of the principal findings. A topical index is provided. GRA

N77-30017# Decisions and Designs, Inc., McLean, Va.
TESTING PROCEDURES IN THE DESIGN OF MANAGEMENT SYSTEMS: SOME METHODOLOGICAL REFLECTIONS
R. V. Brown and S. R. Watson (Cambridge Univ, Engl.) Feb. 1977 38 p refs
(Contracts N00014-76-C-0074; N00014-74-C-0263)
(AD-A040630; DT/TR-77-1) Avail: NTIS HC A03/MF A01 CSCL 05/1

The introduction (or modification) of a management system in an organization is often preceded by an effort to gather data from which it can be evaluated. The data may come from some kind of experiment, a conceptual simulation, or some more informal analysis of relevant past experience. This paper discusses how such alternative testing procedures can themselves be evaluated by paying particular attention to analogous testing paradigms in the more established fields of science and engineering. Decision-aiding systems for naval command control are used as an illustrative case. Author (GRA)

N77-30018# Army Electronics Command, Fort Monmouth, N.J.
INTRODUCTION TO MULTIPLE STATE MULTIPLE ACTION DECISION THEORY AND ITS RELATION TO MIXING STRUCTURES
Bernard Francis Engebos Jan. 1977 59 p refs
(AD-A036371; ECOM-5810) Avail: NTIS HC A04/MF A01 CSCL 05/1

A general mathematical framework is developed which addresses the problem of determining an optimal, or near optimal, course of action, when the outcome of a given course of action is known to be influenced by an evolving state of nature. In this context the advantage of knowledge of the natural state is balanced by the cost of obtaining this information. Such a structure, when considered as functioning over a given time interval, permits employment of life cycle cost versus possible gain. All the mathematical structures and related entities, and the underlying properties thereof, are developed in a manner that such tradeoff studies are possible. The theoretical development as presented is related to that of statistical game theory but with a broader set of objectives. Multiple aspects for the state of nature, and sets of permissible actions are allowed, with these actions being capable of simultaneous performance. This leads to the introduction of multiple state multiple action decision theory and its basic framework, the mixing structure. The concept of sensor mixes is defined and related to the possibility of decreasing loss by the spying on the state of nature. The cost of obtaining this information is then balanced against the gain obtained by knowledge of the natural state. A resulting figure of merit may be used to determine the desirability of each sensor mix. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software.*

N77-30019 Stanford Univ., Calif.
INFORMATION PERISHING AND REPLENISHMENT Ph.D. Thesis
Allen Frederick Grum 1976 116 p
Avail: Univ. Microfilms Order No. 77-7093

A notion, widely held by decision analysts but tenuously defined, is that the value of any specific information diminishes over time. This concept, termed information perishing, is rigorously defined and illustrated by the use of a Markov model. The basic decision model is altered to allow an element of uncertainty for the exact timing of the decision. Without this uncertainty the decision maker could simply discount the value of information because of perishing and would reduce his problem to a static case. However, the uncertainty in timing forces consideration of optimal policies of information replenishment. Rules of optimality are developed for singly and multiple occurring decisions. The optimality of periodic replenishment (under certain limiting conditions), is established. Dissert. Abstr.

N77-30020 Illinois Univ., Urbana-Champaign.
EVALUATION OF SELECTED FEATURES OF THE EUREKA FULL-TEXT INFORMATION RETRIEVAL SYSTEM Ph.D. Thesis
James Richard Rinewalt 1976 59 p
Avail: Univ. Microfilms Order No. 77-9158

Evaluations of on-line information retrieval systems largely depend upon monitoring of users' searches and the cooperation of users in interviews and questionnaires. Experiments designed to evaluate various features of an information retrieval system in a controlled environment are described. Features of various systems are evaluated on the basis of their development and implementation cost, their effect on system performance as well as user performance, and the attitude of users toward the feature. Dissert. Abstr.

N77-30021# California Univ., Livermore. Lawrence Livermore Lab.
MONITOR OF DISTRIBUTED DATA SYSTEMS (MODDS). PART 2: DETAILED FUNCTIONAL SPECIFICATIONS
E. W. Birss, J. E. Donnelley, and J. W. Yeh 15 Nov. 1976 44 p
(Contract W-7405-eng-48)
(UCID-17314-Pt-2) Avail: NTIS HC A03/MF A01

Current problems encountered in the interactive use of geographically distributed computer services by the DOT Transportation Systems Center are described and solutions proposed to increase accountability, selection capability, usability, and control of services use. ERA

N77-30022# Los Alamos Scientific Lab., N. Mex.
METRIC GRAPH STRUCTURE FOR INFORMATION RETRIEVAL Ph.D. Thesis - New Mexico Univ., Albuquerque
Karl Jerry Melendez Feb. 1977 67 p refs
(Contract W-7405-eng-36)
(LA-6341-T) Avail: NTIS HC A04/MF A01

When documents (or their abstracts) are stored in a computer memory, a function can be defined which estimates the semantic distance between documents. If this function together with the set of documents forms a metric space, a graph can be constructed to aid the search for the documents with relevant information. Progressive graphs are studied and the search algorithms which use this graph structure are presented. The search algorithms always perform correctly on any progressive graph, but the presence of the progressive property in a graph is not sufficient to insure that the algorithms will work efficiently. The characteristics of a progressive graph which will optimize the search algorithms are discussed, and algorithms to build and optimize progressive graphs are given. Results using the graph, the distance

function property which determines when a graph is a progressive graph is isolated and studied. ERA

N77-30023# Oak Ridge National Lab., Tenn. Finance and Materials Div.
COMMITMENT INFORMATION SYSTEM: USER GUIDE
Ada F. Misek Feb. 1977 33 p
(Contract W-7405-eng-48)
(ORNL-TM-5408) Avail: NTIS HC A03/MF A01

A user guide is presented for a management information system which includes project scheduling, status, and reporting in its finance and materials data base. The operation of the system is described along with a disscussion of the types of information input, the reports issued, options available, computer programs used, and the timing of update. Procedures are given for protecting the data base, and for deleting records. ERA

N77-30024# Abt Associates, Inc., Cambridge, Mass.
RESOURCE CENTER GUIDE
Susan Stearns Callahan, Maria Cohen, ed., and Robert W. Ericson 1976 67 p refs
(PB-266239/3; AAI-76-120; DLMA-20-25-75-42-1; ISBN-0-89011-504-4) Avail: NTIS HC A04/MF A01 CSCL 05B

Procedures for setting up a resource center in a regional office of the Employment and Training Administration are outlined. GRA

N77-30025 Environmental Protection Agency, Washington, D.C. Library Systems Branch.
ENVIRONMENTAL PROTECTION AGENCY LIBRARY SYSTEM BOOK CATALOG. HOLDINGS FOR THE YEAR 1976
Apr. 1977 452 p
(PB-266173/4; EPA-LIB-77-01) Avail: NTIS HC A20/MF A01 CSCL 05B

A union catalog of book holding in the Environmental Protection Agency's library system is presented. This single volume covers the period from January to December 1976 and includes 4,055 unique titles and 16,367 associated records, of which 5,883 represent holdings. GRA

N77-30026# Illinois Univ., Urbana-Champaign. Coordinated Science Lab.
SUPERIMPOSED CODING VERSUS SEQUENTIAL AND INVERTED FILES
Thomas Butler Hickey Mar. 1977 143 p refs
(Contract DAAB07-72-C-0259)
(AD-A040685; UILU-ENG-77-2208; R-761) Avail: NTIS HC A07/MF A01 CSCL 09/2

The relative efficiency of three computer search algorithms was compared for searching large bibliographic files with Boolean search strategies. The sequential and inverted files represent the two most common file structures used today for bibliographic searching. Superimposed coding is an alternative that is becoming more attractive as the speed of computers improves. The superimposed search has a key associated with each record in the data base to act as a screen to eliminate the majority of records from further consideration. The keys are based on the bigrams and trigrams contained in the record, and are arranged in a linear file. The sequential search is a character by character scan of the entire file. This search is facilitated by constructing a finite state machine at the beginning of the search to match the search terms. The inverted file is fairly standard, except for the use of bit vectors to hold the postings of very common entries. A data base of 100,000 INSPEC records, from nine months of 1974, was used for testing the algorithms with 339 real-life search questions. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N77-30027# Brookhaven National Lab., Upton, N. Y.
INPUT-OUTPUT CAPITAL COEFFICIENTS FOR ENERGY TECHNOLOGIES
R. G. Tessmer, Jr. Dec. 1976 32 p refs
(Contract EY-76-C-02-0016)
(BNL-50608) Avail: NTIS HC A03/MF A01

Input-output capital coefficients are presented for five electric and seven nonelectric energy technologies. They describe the durable goods and structures purchases (at a 110 sector level of detail) that are necessary to expand productive capacity in each of twelve energy source sectors. Coefficients are defined in terms of 1967 dollar purchases per million Btu of output from new capacity, and original data sources include Battelle Memorial Institute, the Harvard Economic Research Project, The Mitre Corp., and Bechtel Corp. The twelve energy sectors are coal, crude oil and gas, shale oil, methane from coal, solvent refined coal, refined oil products, pipeline gas, coal combined-cycle electric, fossil electric, LWR electric, HTGR electric, and hydroelectric. ERA

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N77-30028# Committee of Conference (U. S. Congress).
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AUTHORIZATION ACT, 1978
Washington GPO 1977 6 p H.R. 4088 enacted into law by the 95th Congr., 30 Jul. 1977
(Pub-Law-95-76; GPO-89-139) Avail: US Capitol, Senate Document Room

The text of the public law authorizing appropriations to NASA for research and development, construction of facilities, and research and program management is presented. A.R.H.

N77-30029# Committee on Public Works and Transportation (U. S. House).
REFORM OF THE ECONOMIC REGULATION OF AIR CARRIERS
Washington GPO 1976 1752 p refs Hearings before subcomm. on Aviation of the Comm. on Public Works and Transportation, 94th Congr., 2d Sess., 5-6, 11-13, 18-20, 25-27 May, 1, 8-9, 16, 22-24, 29 Jun.; 1 Jul. 1976
(GPO-77-083) Avail: Subcomm. on Aviation

Issues which divide supporters and opponents of proposed reform in the economic regulation of air carriers are discussed in testimony delivered and materials received by the committee. The economic consequences of increased competition and the substantial differences in the various proposals made are explored by representatives of the airlines and various state and Federal Government representatives. A.R.H.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N77-30030 Johns Hopkins Univ., Baltimore, Md.
A METHOD FOR EVALUATING MANAGEMENT OPTIONS FOR AN URBANIZING WATERSHED Ph.D. Thesis
Robert M. Hirsch 1977 267 p
Avail: Univ. Microfilms Order No. 77-7733

The effectiveness of eight different management options for the Holmes Run watershed (Fairfax County, Virginia) was tested with a year 2000 land use projection. An eleven year record of twenty storm events from the Holmes Run watershed was

simulated under each of the eight management options and the simulated flood discharges under each of the options at various locations in the watershed were compared. A multi-objective decision making technique, robust effectiveness analysis (REA), is applied to the problem of selecting a management option. The REA relies on three metrics of performance: flood damage; channel enlargement; and construction cost. Two simple value judgements are elicited from the decision makers. With this information, the analyst identifies the preferred option from among the eight. Dissert. Abstr.

N77-30031 Cornell Univ., Ithaca, N.Y.
BIOLOGICAL RENOVATION OF AMMONIA BRINE PRODUCED BY A PHYSICAL-CHEMICAL WASTEWATER TREATMENT PROCESS Ph.D. Thesis
Alan Fong Yen, 1976 234 p
Avail: Univ. Microfilms Order No. 77-8386

Selective ammonia ion exchange using clinoptilolite was determined to have the greatest potential of various physical-chemical processes for ammonia removal from wastewater. However, the ion exchange process produces concentrated ammonia brine that requires renovation. Experimental results indicated that biological renovation of the brine would be technically feasible. Ammonia brine containing 200 mg per 1 NH3-N, total dissolved solids (TDS) up to 20,000 mg per 1 (0.35 M sodium) can be successfully nitrified at 20 C. More than 99 percent ammonia oxidation and greater than 84 percent nitrite oxidation were obtained. A dissolved oxygen concentration of 3 mg per 1 or higher was necessary to maintain stable nitrite oxidation. Growth rates of the nitrifying bacteria were reduced apparently due to sodium inhibition: the computed limiting minimum solids retention time was approximately seven days. High ammonia strength feed (1,200 mg per 1 N) appeared to be inhibitory to nitrification. The influence of influent ammonia concentration is related to inhibition of the nitrifying culture by unionized free ammonia and/or undissociated nitrous acid. Dissert. Abstr.

N77-30032 Purdue Univ., Lafayette, Ind.
EVALUATION OF ACTIVATED SLUDGE HYDRAULIC CONTROL TECHNIQUES THROUGH PILOT PLANT ANALYSES Ph.D. Thesis
Ralph Edward Roper, Jr. 1976 290 p
Avail: Univ. Microfilms Order No. 77-7523

A hydraulic control formula was developed which can be applied to a wide variety of control situations and made plant specific by a simple calibration technique. Its use in controlling an activated sludge system in which the key parameters are sludge age or mean cell residue time is demonstrated and verified through the use of two 850 gal/day activated sludge pilot plants. Analysis of the pilot plant operational data show that the efficacy of the hydraulic control formula is related to the radio of the effluent suspended solids concentration to the influent substrate concentration. Calibration of the control formula serves to minimize the influence of that ratio. Three different techniques for calibrating the control formula were investigated. Dissert. Abstr.

N77-30033# Brookhaven National Lab., Upton, N. Y.
NUTRIENTS, TOXINS, AND WATER IN TERRESTRIAL AND AQUATIC ECOSYSTEMS TREATED WITH SEWAGE PLANT EFFLUENTS Final Report
G. M. Woodwell (Marine Biological Lab., Woods Hole, Mass.), J. T. Ballard, J. Clinton, and E. V. Pecan Jan. 1976 43 p refs
(Contract EY-76-C-02-006)
(BNL-50513) Avail: NTIS HC A03/MF A01

The capacity of terrestrial and aquatic plant communities for absorbing and retaining nutrients and organic matter in sewage and for releasing clean water was approved. Experimental systems included a sere representative of the Eastern Deciduous Forest, a timothy field, two Phalaris arundinacea meadows, a freshwater marsh, a pond, and a marsh pond complex. Sewage of two qualities was applied at the rate of 5 cm per week; one treatment was equivalent to the release from a primary treatment sewage plant, the second to that from a secondary treatment plant. Under normal circumstances, without the addition of water or nutrients in sewage, the flux of nutrients into the groundwater was greatest under the agricultural communities and least under the late successional forest communities. All the terrestrial communities were net sources of most elements. ERA

N77-30034# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
RAW MATERIALS AND TRANSPORT
R. Hemingway, G. Lambert, F. G. Maccabee, and N. J. Ashford Mar. 1977 201 p refs
(Contract B-RG-5269-1)
(TT-7604) Avail: NTIS HC A10/MF A01

The consumption and utilization of metals, rubber, plastics, and road building materials in transport systems are examined. The resources of those materials with important transport applications are discussed and their future availability assessed. The relationship between raw materials and energy consumption is considered and the energy cost of producing transport vehicles estimated. The desirability of conserving those materials which may face depletion within the foreseeable future is discussed and the potential for recycling, product life extension and materials substitution examined, with particular reference to the private car. Author (ESA)

N77-30035# Arizona State Univ., Tempe. Dept. of Mechanical Engineering.
GUIDEWAY - VEHICLE COST REDUCTION. PART 1: GUIDEWAY - VEHICLE PERFORMANCE AND COSTS Final Report
D. L. Klinger, N. K. Cooperrider, J. K. Hedrick, R. C. White, A. Calzado, M. Sayers, and D. Wormley 9 Jul. 1976 159 p refs 2 Vol.
(Contract DOT-OST-50107)
(PB-265966/2; DOT-TST-76-95-1) Avail: NTIS HC A08/MF A01 CSCL 13F

The cost and performance benefits of using improved suspensions in passenger railcars were investigated to determine if improved vehicle suspensions can reduce overall system cost by allowing lower guideway maintenance standards. Cost determinations are limited to guideway annual maintenance and vehicle suspension installation and maintenance. Transfer function models of passenger railcar and bus dynamics, and power spectral density models of guideway disturbances are developed. Preliminary guideway and suspension cost data are also analyzed. GRA

N77-30036# Arizona State Univ., Tempe. Dept. of Mechanical Engineering.
GUIDEWAY - VEHICLE COST REDUCTION. PART 2: ACTIVE SUSPENSION FEASIBILITY Final Report
D. L. Klinger, N. K. Cooperrider, J. K. Hedrick, R. C. White, A. Calzado, M. Sayers, and D. Wormley 9 Jul. 1976 82 p refs 2 Vol.
(Contract DOT-OST-50107)
(PB-265967/0; DOT-TST-76-95-2) Avail: NTIS HC A05/MF A01 CSCL 13F

The design of a low power pneumatic concept is presented along with an assessment of the feasibility of active suspension systems. A preliminary suspension/guideway maintenance cost tradeoff is described which shows that active suspensions are cost effective for low vehicle density routes. GRA

N77-30037# National Center for Resource Recovery, Washington, D. C.
MAGNETIC SEPARATION: RECOVERY OF SALEABLE IRON AND STEEL FROM MUNICIPAL WASTE
Harvey Alter and Kenneth L. Woodruff Mar. 1977 30 p refs
(Contract EPA-68-01-2625)
(PB-266114/8; EPA-530/SW-559) Avail: NTIS HC A03/MF A01 CSCL 13B

This pamphlet is an introduction to the technology, economics and objectives of magnetic separation. It should serve as a preliminary planning and decision guide for a municipality considering the addition of the magnetic separation process to its present solid waste management system. GRA

N77-30038# General Accounting Office, Washington, D.C. Community and Economic Development Div.
REPORT TO THE CONGRESS BY THE COMPTROLLER

GENERAL OF THE UNITED STATES. BETTER DATA COLLECTION AND PLANNING IS NEEDED TO JUSTIFY ADVANCED WASTE TREATMENT CONSTRUCTION
21 Dec. 1976 86 p refs Sponsored in part by EPA
(PB-266452/2; CED-77-12; B-166506) Avail: NTIS HC A05/MF A01 CSCL 13B

The Federal Water Pollution Control Act Amendments of 1972 require that comprehensive area-wide and basin plans be prepared for determining the best course of action to follow for improving water quality. The U.S. Geological Survey was successful in gathering adequate water quality data on the Willamette River in Oregon and, as a result, was able to identify more effective and efficient methods for achieving Oregon's water quality standards than through treatment, as originally planned. The potential benefits which may be realized from gathering good water quality data may result in savings of several millions of dollars in Federal, State and local construction funds. GRA

N77-30039# Environmental Protection Agency, Washington, D.C. Municipal Construction Div.
MANUAL OF REFERENCES (REGULATIONS, GUIDANCE, PROCEDURES). MUNCIPAL WASTEWATER TREATMENT WORKS CONSTRUCTION GRANTS PROGRAM, SUPPLEMENT NUMBER 3
Jan. 1977 36 p
(PB-266731/9; EPA-MCD-02.3) Avail: NTIS HC A03/MF A01 CSCL 13B

This handbook contains the replacement pages and policy directives issued after the Manual of References, MCD-02, was published. This represents the third in a series of Program Requirements Memoranda. GRA

N77-30040# Oklahoma State Univ., Stillwater. Center for Local Government Technology.
A PIGGYBACK AND NETWORKING SYSTEM FOR INCREASING TECHNOLOGY TRANSFER TO UNITS OF LOCAL GOVERNMENT Interim Progress Report, 1 Jul. 1976 - 1 Jan. 1977
Jan. 1977 20 p
(Grant NSF ISP-74-01418-A04)
(PB-266616/2; NSF/RA-770051) Avail: NTIS HC A02/MF A01 CSCL 05D

The Center for Local Government Technology at Oklahoma State University is working with the land-grant universities in Nebraska, Louisiana, and Arkansas in an experimental effort to explore the potential for these states to develop technology transfer programs for local governments to determine if newly emerging programs can significantly benefit by 'piggybacking' on the efforts of a similar program which has already been through the start-up process. The concept of 'networking' is the process of interchange and implementation of technical information and successful technology-based programs between established centers for technology transfer. GRA

88 SPACE SCIENCES (GENERAL)

N77-30041*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THREE-DIMENSIONAL RANDOM EARTH ATMOSPHERES FOR MONTE CARLO TRAJECTORY ANALYSES
Janet W. Campbell Washington Aug. 1977 47 p refs
(NASA-TM-X-3529; L-10623) Avail: NTIS HC A03/MF A01 CSCL 04A

A set of four computer tapes containing random three dimensional Earth atmospheres is available for Monte Carlo trajectory analyses. The tapes contain sufficient atmospheric tables to allow replications of any trajectory below an altitude of 99 km. The atmospheres were provided by an empirical model designed to generate random atmospheres whose distributions match those in a data base of sounding rocket measurements. A readily implementable means of linking the tapes to any existing trajectory simulation computer program is described involving the addition of three subroutines which are listed in an appendix. Author

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N77-30042 Arizona Univ., Tucson.
THE SPATIAL STRUCTURE ANALYZER AND ITS ASTRONOMICAL APPLICATIONS Ph.D. Thesis
James Bernard Breckinridge 1976 232 p
Avail: Univ. Microfilms Order No. 77-2335

An achromatic prism interferometer with 180 deg. rotational shear is the essential element of a package which permits real - time processing of two dimensional optical image information by displaying the real part of the spatial-frequency Fourier transform. If functions with coherent or laser sources as well as incoherent or white-light sources. The instrument's capabilities and limitations, including engineering design, construction, assembly, alignment, and applications in science and engineering are discussed. Dissert. Abstr.

N77-30043 Illinois Univ., Urbana-Champaign.
THE MAGNETOSPHERES OF ACCRETING NEUTRON STARS Ph.D. Thesis
Ronald Fred Elsner 1976 239 p
Avail: Univ. Microfilms Order No. 77-8983

The theory of accretion onto magnetic neutron stars is studied for the case when the accretion flow is radial and the neutron star is rotating. The formation and structure of the star's magnetosphere, the physical processes that occur in the neighborhood of the magnetospheric boundary and the manner in which the accreting plasma enters the magnetosphere is investigated. Two extreme examples of possible flows within the magnetosphere, and their effects on X-ray emission from the stellar surface, are described. Analytical and numerical solutions for the flow and cooling plasma in the region between the standoff shock wave outside the magnetosphere and the magnetospheric boundary are presented for the case when the plasma there is exposed to X-rays. The applicability of the calculations to observed compact X-ray sources and some implications for X-ray burst sources are discussed. Dissert. Abstr.

N77-30044 Cornell Univ., Ithaca, N.Y.
ANALYSIS AND APPLICATION OF A MULTI-BEAM RADIO ASTRONOMY SURVEY Ph.D. Thesis
Dale Joel Pleticha 1976 264 p
Avail: Univ. Microfilms Order No. 77-8374

A radio telescope was used to produce a confusion limited survey of one steradian of sky at 611 MHz; ten line feeds were used simultaneously in the meridian transit mode. The positions and flux densities of the 3012 radio sources stronger than 0.35 Janskys were measured. This thesis discusses the advantages of multiple-beam observations. The antenna, receivers, and data taking systems are described, and special calibration techniques are explained. The organization of the survey data on a single magnetic tape is outlined. An appendix includes standard computer programs developed to read the tape and to display the data. The survey data are used in two statistical analyses. First, the clustering of radio sources near classes of optical objects is investigated. Second, the very weak radio emission from classes of optical objects is estimated. Dissert. Abstr.

N77-30045*# State Univ. of New York, Geneseo.
A COMPARISON OF LYMAN ALPHA AND HeI LAMBDA 10830 LINE STRUCTURE AND VARIATIONS IN EARLY-TYPE STAR ATMOSPHERES Final Report
D. D. Meisel 1977 13 p refs Prepared in cooperation with State Univ. of New York Research Foundation, Geneseo
(Grant NGR 33-219-002)
(NASA-CR-154269) Avail: NTIS HC A02/MF A01 CSCL 03A

Fabry-Perot interferometric profiles for fifty of the early-type stars including supergiants, eclipsing binaries, Bp and Ap stars, Be and shell stars, and variable stars have been obtained. Results for beta Persei (Algol) just before primary and secondary eclipses show strong emission profiles lasting about 0.1 phase. An absorption line was seen during secondary eclipse. Bright supergiant stars (O9-A2) show time-variable, complicated

absorption/emission profiles similar to those obtained for the Be/shell stars. Author

N77-30046# Max-Planck-Institut fuer Astronomie, Heidelberg (West Germany).
BALLOON-BORNE TELESCOPE THISBE 1: TECHNOLOGY, RESULTS, EXPERIENCE
Dietrich Lemke, Albrecht Frey, Klaus Haussecker, Wilfried Hofmann, Norbert Salm, and Hubert Schuetz Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1976 94 p refs In GERMAN; ENGLISH summary
(Contract BMFT-WRK-253)
(BMFT-FB-W-76-29) Avail: NTIS HC A05/MF A01; ZLDI, Munich DM 19.75

The present status of the balloon-borne telescope Thisbe 1 is the result of continual rebuilding and improvement. Up to now 11 stratospheric flights have been performed. The gondola was recovered virtually undamaged after all flights. Four telescopes for observations from the ultraviolet through the infrared region were developed for Thisbe. Results of observations of the zodiacal light, galactic center, and airglow are presented. Further observations with Thisbe 1 are in preparation. A new highly stabilized balloon-borne telescope is being constructed.
Author (ESA)

N77-30047# European Southern Observatory, Munich (West Germany).
[ACTIVITIES OF THE EUROPEAN SOUTHERN OBSERVATORY] Annual Report, 1976
1977 32 p refs
Avail: NTIS HC A03/MF A01

A summary of the research work done by staff and visiting astronomers particularly in galaxies, clusters, binaries, and the sky survey is made. The facilities of the observatory - telescopes, instrumentation, buildings and grounds - are described. Financial and organizational matters are reviewed. ESA

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N77-30048 Notre Dame Univ., Ind.
COUPLED GRAVITATIONAL AND ELECTROMAGNETIC PERTURBATIONS AROUND A CHARGED BLACK HOLE Ph.D. Thesis
Chul Hoon Lee 1977 103 p
Avail: Univ. Microfilms Order No. 77-7378

The Newman-Penrose formalism was used to investigate coupled gravitational and electromagnetic perturbations of a charged black hole. Coupled equations governing perturbations away from the Kerr-Newman background solution are derived. These equations do not look separable in general, yet, when restricted to the nonrotating case, they can be separated in Schwarzchild coordinates. The asymptotic solutions of the separated equations show that the net energy flux of the coupled gravitational and electromagnetic waves scattered on a Reissner-Nordstrom black hole is radially inward at infinity, that there is no superradiant scattering. The nontrivial part of the perturbation of a Reissner-Nordstrom black hole is determined. It is shown that the only well-behaved perturbations are those corresponding to an infinitesimal change in mass, charge and angular momentum parameters of the black hole. Dissert. Abstr.

N77-30049 State Univ. of New York, Stony Brook.
THE FINITE, UNIFORMLY ROTATING, GASEOUS DISK: A STABILITY ANALYSIS Ph.D. Thesis
William Morley Smith 1976 118 p
Avail: Univ. Microfilms Order No. 77-7778

The stability of this system to infinitesimal perturbation is studied. The equilibrium model is bound by its self-gravity, and supported against collapse by a combination of centrifugal force and internal pressure; density and pressure gradients are present. An exact, but linear, analytic solution to the problem of normal modes is found, and a characteristic equation is derived for the eigen-frequencies. Three distinct types of compressional instabilities are noticed. A growing bar-like disturbance manifests itself whenever the ratio of the total rotational kinetic energy of the equilibrium disk to the total gravitational potential energy of said disk, is greater than 0.125. A Wentzel-Kramer-Brillouin analysis was performed for both large radial azimuthal wavenumbers. The agreement between the eigenfunctions and eigenvalues of the exact and approximate analyses is excellent.
Dissert. Abstr.

N77-30050# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
[RESEARCH ACTIVITIES OF THE INSTITUTE FOR EXTRATERRESTRIAL PHYSICS] Annual Report, 1976 [TAETIGKEITSBERICHT 1976]
Jan. 1977 222 p refs In GERMAN
(MPI-PAE/Extraterr-132) Avail: NTIS HC A10/MF A01

Topics covered include: magnetosphere, interplanetary space, infrared astronomy, X-ray astronomy, gamma astronomy, primary cosmic rays, and laboratory spectroscopy. ESA

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N77-30051 Florida Univ., Gainesville.
GROUNDBASED AND SPACECRAFT STUDIES OF JUPITER AT DECAMETER AND HECTOMETER WAVELENGTHS Ph.D. Thesis
Michael Daniel Desch 1976 227 p
Avail: Univ. Microfilms Order No. 77-8164

The low frequency Jovian emission between 450 kHz and 26.3 MHz has provided information on a component of Jovian emission which is three orders of magnitude weaker than that detected with conventional radiometer systems. Deployment of the earth orbiting Radio Astronomy Explorer 1 satellite was used to identify Jovian activity at eight frequencies between 450 and 6550 kHz. Both the ground based and spacecraft systems are described, as are the procedures which were developed to obtain their absolute effective apertures and pointing directions.
Dissert. Abstr.

N77-30052 Cornell Univ., Ithaca, N.Y.
THE INTERIOR OF JUPITER Ph.D. Thesis
David John Stevenson 1976 190 p
Avail: Univ. Microfilms Order No. 77-8408

The thermodynamics of hydrogen-helium fluid mixtures were calculated for the range of pressures and temperatures relevant to the interior of Jupiter. A hard sphere perturbation theory was used to calculate the Helmholtz free energy. In the metallic regime, the electrostatic energy was evaluated to the third order in the screened electron-ion interaction. The heat transport processes were investigated. In the molecular envelope, hydrogen alone does not have sufficient opacity to insure convection in the deep atmosphere, but other molecular species are probably sufficiently opaque. Models of the Jovian interior were constructed to evaluate the rotational response of the planetry shape to the third order in the ratio of centrifugal to gravitational potentials.
Dissert. Abstr.

N77-30053 Cornell Univ., Ithaca, N.Y.
ELECTRODYNAMICS AND THE MOON: TRANSPORT PROCESSES Ph.D. Thesis
Gregory John Williams 1976 266 p
Avail: Univ. Microfilms Order No. 77-8418

The rock powder that largely covers the lunar surface has suffered some transportation over geologic times by means other than the blasting of meteoritic impacts. In the absence of an atmosphere, electrical forces acting on small grains may be a major effect causing surface movements. The various electrical charging effects likely to occur on the lunar surface in the presence

of solar photon bombardment are discussed with particular interest in the circumstances that cause intense microscopic electric fields. The potential of the various types of exposure data for discriminating between proposed histories of the lunar surface material is assessed. The limits (set by exposure data) upon the extent to which grain-by-grain, non-meteoritic transport or accumulation processes can have operated in the later stages of lunar history are discussed. Dissert. Abstr.

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N77-30054 Pennsylvania State Univ., University Park.
NONTHERMAL ELECTRONS IN SOLAR FLARES Ph.D. Thesis
Donald Foster Neidig 1976 145 p
Avail: Univ. Microfilms Order No. 77-8891

Coordinated microwave and H alpha patrol observations verify the existence of a near-proportionality between the strength of the magnetic field in the flare and the frequency of the peak in the impulsive microwave burst. This relationship is then used to determine that the peak flux in the impulsive microwave burst, the peak 20-keV flux in the impulsive X-ray burst, and the maximum H alpha line width are modulated by the magnetic field strength. These observations are consistent with the hypothesis that the density of nonthermal electrons in these flares varies roughly as the 2.5 power of the characteristic magnetic field strength. H alpha observations of the bipolar kernels in flares are interpreted in terms of a model magnetic field consisting of a flux tube connecting two regions of opposite polarity. The relative H alpha line widths of the kernels appear to be controlled only by the relative strength of the magnetic fields in the kernels. Dissert. Abstr.

N77-30055 California Univ., San Diego.
STRUCTURE OF THE SOLAR WIND INFERRED FROM INTERPLANETARY SCINTILLATIONS Ph.D. Thesis
David Gilbert Sime 1976 244 p
Avail: Univ. Microfilms Order No. 77-8729

Interplanetary scintillations data taken at 73.8 MHz are used to build up an average, three-dimensional distribution of the solar wind velocity over periods of several solar rotations. On an average, the highest velocities come from regions in the corona with the lowest densities. The use of scintillation observations to detect flare associated disturbances out of the ecliptic is also discussed and some examples given. Finally, observations of the scintillation index for the radio sources 3C48, 3C144, 3C147, 3C161, 3C237, 3C273, 3C298, and 3C459 are reported. As far as possible, all the data are interpreted using theoretical predictions from a power law model for the interplanetary medium. Dissert. Abstr.

N77-30056# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 391. PART 1: PROMPT REPORTS. DATA FOR FEBRUARY 1977-JANUARY 1977
Helen E. Coffey Mar. 1977 123 p
(PB-267241/8; SGD-391-Pt-1; NOAA-77041311) Avail: NTIS HC A06/MF A01 CSCL 03B

Data for February 1977 are provided on: alert periods, daily solar indices, solar flares, solar radio waves, solar X-ray radiation, coronal holes, solar wind measurements, spacecraft observations, inferred IP magnetic field polarites and mean solar magnetic field. Also reported are data for January 1977 on: daily solar activity center, sudden ionospheric disturbances, solar radio waves, cosmic rays, geomagnetic indices and radio propagation indices. GRA

N77-30057# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR GEOPHYSICAL DATA NUMBER 391. PART 2: COMPREHENSIVE REPORTS. DATA FOR SEPTEMBER 1976 - AUGUST 1976 AND MISCELLANEA
Helen E. Coffey Mar. 1977 57 p
(PB-267242/6; SGD-391-Pt-2; NOAA-77041312) Avail: NTIS HC A04/MF A01 CSCL 03B

This comprehensive report for September 1976, August 1976, and Miscellanea provides data on: active regions, synoptic solar map, solar flares, solar radio waves, energetic solar particles and plasma, solar X-ray radiation, abbreviated calendar record, and regional flare index. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N77-30058 California Inst. of Tech., Pasadena.
THE STREAMING OF 1.3 - 2.3 MeV COSMIC-RAY PROTONS DURING PERIODS BETWEEN PROMPT SOLAR PARTICLE EVENTS Ph.D. Thesis
Francis Elbert Marshall 1977 176 p
Avail: Univ. Microfilms Order No. 77-7394

The anisotropy of 1.3 - 2.3 MeV protons in interplanetary space was measured using the Caltech electron/isotope spectrometer aboard IMP-7 for 317 6-hour periods. The convective and diffusive anisotropies are determined from the observed anisotropy using concurrent solar wind speed measurements and observed energy spectra. The diffusive flow of particles is found to be typically toward the sun, indicating a positive radial gradient in the particle density. This anisotropy is inconsistent with previously proposed sources of low-energy proton increases seen at 1 AU which involve continual solar acceleration. Dissert. Abstr.

N77-30059 Michigan Univ., Ann Arbor.
VARIATIONS IN THE CIRCULAR POLARIZATION OF EXTRAGALACTIC RADIO SOURCES AT 8 GHz Ph.D. Thesis
Philip Eaton Hodge 1976 90 p
Avail: Univ. Microfilms Order No. 77-7938

A 26 meter radio telescope with a rotatable feed was used to detect significant circular polarization from 3C 279, and variable circular polarization from 3C 84 and 3C 273. The circular polarization from at least 3C 273 and 3C 279 is due to linear to circular conversion within the source. The circular polarization from 3C 84 is attributed to synchrotron emission. The variation in the circular polarization of 3C 273 occurred during an outburst in the total flux density resulting in a change in optical depth. The optical depth of 3C 84 also changed when its circular polarization was varying. Dissert. Abstr.

N77-30060 California Univ., San Diego.
OBSERVATIONS OF HARD X-RAYS FROM EXTRAGALACTIC OBJECTS Ph.D. Thesis
Richard Fred Mushotzky 1976 168 p
Avail: Univ. Microfilms Order No. 77-8728

An OSO-7 borne, actively shielded scintillation type X-ray telescope having a sensitive area of 64 sq cm and an augmented angular response of 6.5 deg FWHM was used to determine the high energy spectrum of six extragalactic radio sources. The hard X-ray spectrum of Cen-A and 2C390.3 were measured and sensitive limits upper limits to the flux from 3C111, 3C129, and M87 were set. Several theoretical models are considered to account for the hard X-ray emission from compact extragalactic X-ray sources, including a two temperature accretion disk black hole model. Dissert. Abstr.

N77-30061 Cornell Univ., New York.
VARIABILITY OF HIGH ENERGY RADIATION FROM THE CRAB PULSAR, NP PHI 532 Ph.D. Thesis
Mark Samuel Strickman 1976 187 p
Avail: Univ. Microfilms Order No. 77-8410

The Cornell 100' gas Cerenkov gamma-ray telescope was flown for a third observation of the Crab pulsar, Np phi 32, to further examine possible intensity variations at high gamma-ray energies. Because of a failure in the electronics, the thresholds

used were 200 MeV and 450 Mev. Above 200 MeV, no significant effect was observed, but positive excesses were present at the proper phase locations. Above 450 MeV, a peak of about 5.5 standard deviations above the background was observed coincident (to within timing error) with the predicted main peak. A positive excess of ion significance occurred at the secondary peak location. A model using absorption via pair production in the magnetic field of the pulsar was formulated as a speculation about the cause of this phenomenon. Dissert. Abstr.

N77-30062 Johns Hopkins Univ., Baltimore, Md.
A ROCKET OBSERVATION OF THE FAR ULTRAVIOLET (1160-1700 A) EMISSION SPECTRUM OF CAPELLA Ph.D. Thesis
Robert Charles Vitz 1977 126 p
Avail: Univ. Microfilms Order No. 77-7764

A far-ultraviolet spectral survey of Capella (alpha Aur, G5 III + GO III) was obtained, using a highly sensitive rocket-borne spectrograph with a multi-spectral element detector. Details of the instrumentation, calibration, flight, and spectrum analysis are described. The experimental package consisted of a pointing telescope and a LiF prism spectrograph with a chevron microchannel plate detector. The observed spectral distribution is very similar to that of the sun; however, if the line surface fluxes are due to the primary (G5 III), then, except for L alpha, they are about an order of magnitude greater than those of the average sun. An analysis of the UV emission lines indicates a narrow chromosphere-corona transition region with a pressure of 1.6 dynes per sq cm and a coronal temperature greater than K. Dissert. Abstr.

N77-30063 Johns Hopkins Univ., Baltimore, Md.
A HIGH SENSITIVITY SOUNDING ROCKET OBSERVATION OF THE FAR ULTRAVIOLET (1160-1700 A) SPECTRUM OF ARCTURUS Ph.D. Thesis
Arthur Weinstein 1977 187 p
Avail: Univ. Microfilms Order No. 77-8284

This spectrum of the K2 3p star, Arcturus, was obtained using a highly sensitive rocket-borne spectrograph with a multi-element microchannel plate detector. The results of this observation are: (1) the detection of emissions of the H1 L alpha and O1 1304 A bands, and the O1 1356 A band which has previously been undetected; (2) the detection of a broad unresolved emission extending from approximately 1460 A to 1560 A and centered at 1510 A; (3) the determination of low upper limits to emissions present on the sun but undetected or unresolved on Arcturus; (4) the calculation of coronal base pressure upper limits which indicate the possibility of a pressure which may be lower than previously determined; and (5) the cross calibration of other Arcturus data. The two measurements of L alpha agree within ten percent of each other. Dissert. Abstr.

99 GENERAL

N77-30064# Committee on Science and Technology (U. S. House).
ASTRONAUTS AND COSMONAUTS BIOGRAPHICAL AND STATISTICAL DATA
Washington GPO 1977 212 p refs Rept. for Comm. on Sci. and Technol., 95th Congr., 1st Sess., Jul. 1977 Prepared by the Library of Congr., Congressional Res. Service
(GPO-91-798) Avail: Comm. on Sci. and Technol.

Photographs and biographical sketches of all present and former astronauts of NASA, the X-15, X-20 Dyna-Soar, and Manned Orbiting Laboratory programs are presented along with similar data about Russian cosmonauts. Included are tables showing their current status, cumulative space and EVA time, and comparative data on U.S. and Soviet space flights. The criteria for astronaut selection is included. A.R.H.

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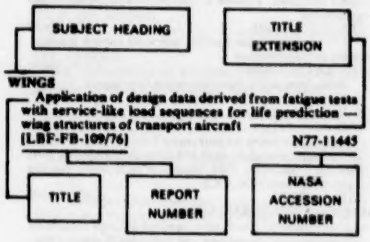

The subject heading is the key to the subject content of the document. Titles, report numbers, and accession numbers of pertinent documents are provided under each subject heading. When the title is insufficiently descriptive of the document content, a title extension has been added, separated from the title by three hyphens. The report number helps to indicate the type of document cited (e.g., NASA report, NASA translation, NASA contractor report). The NASA accession number is the number by which the document abstracts are arranged in this journal and by which the document is sold or requested. The titles, with title extensions if present, are arranged under each subject heading in ascending accession number order. The subject headings have been selected from the latest revision of the *NASA Thesaurus* (NASA SP-7050).

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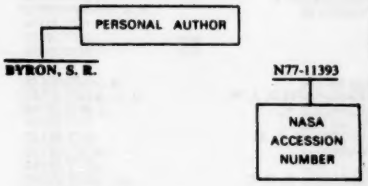

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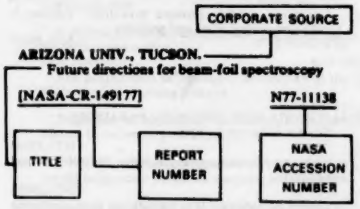

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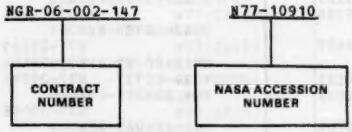

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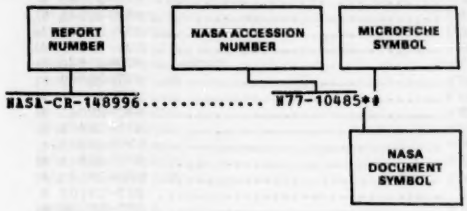

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LC-77-4773 ..... N77-29860 #
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LMSC-D461196 ..... N77-29485 #
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